(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2004-56078
(P2004-56078A)
(43)公開日　平成16年2月19日(2004.2.19)

(51)Int.Cl.[7]	F I		テーマコード（参考）
H01L 21/60	H01L 21/60	311Q	2G011
// G01R 1/073	G01R 1/073	B	5F044

審査請求 有　請求項の数 8　OL　（全 23 頁）

(21)出願番号　特願2003-3508(P2003-3508)
(22)出願日　平成15年1月9日(2003.1.9)
(31)優先権主張番号　特願2002-153062(P2002-153062)
(32)優先日　平成14年5月27日(2002.5.27)
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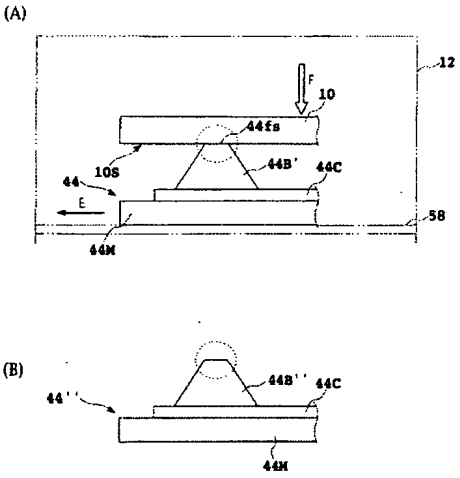
Fターム(参考)　2G011 AA21 AC14 AE22 AF02
5F044 KK17 KK18 KK19

(54)【発明の名称】電極の回復処理方法

(57)【要約】
【課題】摩耗した電極板の電極部の接続面に容易にかつ確実に所定の凹凸を形成することができること。
【解決手段】所定の粗さを有する転写面１０ｓを有する転写板１０の転写面１０ａが転写板１０の線膨張率よりも大なる線膨張率を有する基材４４Ｍ上に形成されるコンタクトシート４４の複数のバンプ４４Ｂに対し所定の圧力で当接されるもとで、基材４４Mおよび転写板１０が所定の温度まで加熱されることにより、バンプ４４Ｂの接続面が所定の粗さの表面に回復されるもの。
【選択図】　図１



【特許請求の範囲】
【請求項１】
絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して該電極部の接続面を介して電気的接続を行う電極板における該電極部の接続面に、該電極板の絶縁基板の線膨張率と異なる線膨張率の材料で作られ、凹凸が形成される表面を有する転写板の該表面と該接続面とを互いに接触するように載置する第１の工程と、
前記第１の工程において前記電極部の接続面に載置された転写板を所定の圧力で該電極部の接続面に向けて押圧しつつ、該転写板および前記電極板を所定温度で所定期間、加熱する第２の工程と、
前記転写板を前記電極板に対して離隔させ、前記電極部の接続面に所定の凹凸を得る第３の工程と、
を含んでなる電極の回復処理方法。
【請求項２】
前記第２の工程における所定温度および所定期間は、それぞれ、８０℃以上から１５０℃未満までの温度範囲で、５分以上１５分以下の期間に設定されることを特徴とする請求項１記載の電極の回復処理方法。
【請求項３】
母材の耐磨耗性に比して優れた耐摩耗性を有する微小な結晶物を該母材中に所定量含んでなる電極部が絶縁基板上に形成され、半導体装置の端子部に対して該電極部の接続面を介して電気的接続を行う電極板における該電極部の接続面に、該半導体装置の端子部を載置する第１の工程と、
前記半導体装置の端子部を前記電極板の接続面に対して接触させつつ該接続面を摩耗させ、前記結晶物の一部を露出させることにより、所定の凹凸を該接続面に得る第２の工程と、
を含んでなる電極の回復処理方法。
【請求項４】
前記結晶物は、前記母材である銅の硬度よりも大なる硬度を有し、かつ、電気伝導度が比較的高いパラジュウムまたはニッケルで作られることを特徴とする請求項３記載の電極の回復処理方法。
【請求項５】
絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して該電極部の接続面を介して電気的接続を行う電極板における該電極部の接続面に、凹凸が形成される表面を有する転写板の該表面と該接続面とを互いに接触するように載置する第１の工程と、
前記第１の工程において前記電極部の接続面に載置された転写板を所定の圧力で該電極部の接続面に向けて押圧しつつ、該転写板または該電極部の接続面を該接続面に対し略平行ないずれかの方向に所定量、少なくとも１回、相対的に移動させる第２の工程と、
前記転写板を前記電極板に対して離隔させ、前記電極部の接続面に所定の凹凸を得る第３の工程と、
を含んでなる電極の回復処理方法。
【請求項６】
前記第２の工程において、前記電極板を支持しつつ前記電極部の接続面に対し略平行に移動させる摺動装置により前記転写板に対し該電極板が移動せしめられることを特徴とする請求項５記載の電極の回復処理方法。
【請求項７】
前記第２の工程における押圧力が、一つの電極部あたり１ｇ以上１００ｇ以下であることを特徴とする請求項１または請求項５記載の電極の回復処理方法。
【請求項８】
前記第２の工程における相対的な移動の所定量が、１μｍ以上１ｍｍ以下であることを特徴とする請求項５記載の電極の回復処理方法。
【発明の詳細な説明】

【０００１】
【発明の属する技術分野】
本発明は、半導体装置の端子に対し電気的接続を行う電極部を有する電極板の電極部の接続面を所定の表面粗さとなるように回復させることができる電極の回復処理方法に関する。
【０００２】
【従来の技術】
電子機器用ＩＣソケットまたはコネクタにおいては、一般に、配線用基板の電極に装着される半導体装置の端子が電気的に確実に接続されることが要望される。このような装置においては、例えば、特開平８－９６８６５号公報、および、特開２０００－２９４０４３号公報にも示されるように、半導体装置の端子（電極）が電気的に接続される導体パターンの電気接点部、あるいは、導電路の端面に、その端子に形成される酸化被膜を突き破るために十分なセラミック溶射被膜を溶射により、または微小突起をエッチング処理により形成することが提案されている。このように微小突起が電気接点部、あるいは、導電路の端面に形成されることにより、互いの接触面積が低減され、かつ、単位面積あたりの接触圧力が増大するので酸化被膜が破壊され易いという効果を奏することとなる。
【０００３】
その結果、半導体装置の端子が配線用基板の電極に電気的に確実に接続されることとなる。
【０００４】
【発明が解決しようとする課題】
上述のような電子機器用ＩＣソケットにおいては、導体パターンの電気接点部が繰り返し使用される場合、上述のような耐磨耗性を有する微小突起およびセラミック溶射被膜の耐久性にも一定の寿命があるので微小突起が接触圧力等により摩耗することとなる。従って、その電気接点部、あるいは、導電路の端面は、使用頻度に応じ回復することなく、凹凸のない略平坦な表面となるので接触面積が増大し、かつ、接触圧力が不十分となる虞がある。その結果、当初得られた確実な電気的な接続が、使用するにつれて得られなくなる場合がある。
【０００５】
以上の問題点を考慮し、本発明は、半導体装置の端子に対し電気的接続を行う電極部を有する電極板の電極部の接続面を所定の表面粗さとなるように回復させることができる電極の回復処理方法であって、摩耗した電極板の電極部の接続面に容易にかつ確実に所定の凹凸を形成することができる電極の回復処理方法を提供することを目的とする。
【０００６】
【課題を解決するための手段】
上述の目的を達成するために、本発明に係る電極の回復処理方法は、絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して電極部の接続面を介して電気的接続を行う電極板における電極部の接続面に、電極板の絶縁基板の線膨張率と異なる線膨張率の材料で作られ、凹凸が形成される表面を有する転写板の表面と接続面とを互いに接触するように載置する第１の工程と、第１の工程において前記電極部の接続面に載置された転写板を所定の圧力で電極部の接続面に向けて押圧しつつ、転写板および該電極板を所定温度で所定期間、加熱する第２の工程と、転写板を前記電極板に対して離隔させ、電極部の接続面に所定の凹凸を得る第３の工程と、を含んでなる。
【０００７】
また、第２の工程における所定温度および所定期間は、それぞれ、８０℃以上から１５０℃未満までの温度範囲で、５分以上１５分以下の期間に設定されてもよい。
【０００８】
さらに、本発明に係る電極の回復処理方法は、母材の耐磨耗性に比して優れた耐摩耗性を有する微小な結晶物を母材中に所定量含んでなる電極部が絶縁基板上に形成され、半導体装置の端子部に対して電極部の接続面を介して電気的接続を行う電極板における電極部の

接続面に、半導体装置の端子部を載置する第１の工程と、半導体装置の端子部を電極板の接続面に対して接触させつつ接続面を摩耗させ、結晶物の一部を露出させることにより、所定の凹凸を接続面に得る第２の工程とを含んでなる。

【０００９】

結晶物は、母材である銅の硬度よりも大なる硬度を有し、かつ、電気伝導度が比較的高いパラジュウムまたはニッケルで作られてもよい。

【００１０】

さらにまた、本発明に係る電極の回復処理方法は、絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して電極部の接続面を介して電気的接続を行う電極板における該電極部の接続面に、凹凸が形成される表面を有する転写板の表面と接続面とを互いに接触するように載置する第１の工程と、第１の工程において電極部の接続面に載置された転写板を所定の圧力で電極部の接続面に向けて押圧しつつ、転写板または電極部の接続面を接続面に対し略平行ないずれかの方向に所定量、少なくとも１回、相対的に移動させる第２の工程と、転写板を電極板に対して離隔させ、電極部の接続面に所定の凹凸を得る第３の工程と、を含んでなる。

【００１１】

また、第２の工程において、電極板を支持しつつ電極部の接続面に対し略平行に移動させる摺動装置により転写板に対し電極板が移動せしめられるものでもよい。

【００１２】

第２の工程における押圧力が、一つの電極部あたり１ｇ以上１００ｇ以下であってもよく、また、第２の工程における相対的な移動の所定量が、１μｍ以上１ｍｍ以下であってもよい。

【００１３】

【発明の実施の形態】

図７は、本発明に係る電極の回復処理方法の第１の実施例、後述する第２の実施例および第３の実施例が適用される接続用電極板を備える半導体装置用ソケットを示す。

【００１４】

図７に示される半導体装置用ソケットにおいては、例えば、半導体装置の電気的特性試験、具体的にはバーンイン試験等に利用されるものとされる。半導体装置用ソケットは、半導体装置としてのベアチップが内部に収容されるキャリアユニット４０と、キャリアユニット４０が着脱可能に収容部に装着されるＩＣソケット３０とを含んで構成されている。

【００１５】

ＩＣソケット３０は、ベアチップへの検査信号およびベアチップからの検出出力信号等の入出力を行なうプリント配線基板３８上に配置され、キャリアユニット４０を収容する収容部を有する本体部３２と、本体部３２に設けられ、キャリアユニット４０における構成要素となる後述する接続用電極板としてのコンタクトシートの各パッドにそれぞれ電気的に接続される複数のコンタクトからなるコンタクト群３４と、本体部３２に対し昇降動可能に配されコンタクト群３４の各接点部を選択的にコンタクトシートの各パッドに選択的に電気的に接続するカバー部材３６とを主な要素として構成されている。

【００１６】

樹脂材料で成形される本体部３２は、プリント配線基板３８の電極部に対応して所定位置に配置されている。本体部３２は、図７に示されるように、キャリアユニット４０が収容される収容部３２Ａを有している。収容部３２Ａは、後述するキャリアユニット４０のベース部の下部に係合される下部基台部３２ａの内周部と、下部基台部３２ａに連なりそのベース部の上部に係合される上部基台部３２ｂの内周部とにより包囲されて形成されている。下部基台部３２ａには、コンタクト群３４が支持されている。下部基台部３２ａおよび上部基台部３２ｂには、コンタクト群３４を構成する各コンタクト３４ａｉ（ｉ＝１～ｎ，ｎは整数）が挿入されるスリットが形成されている。

【００１７】

各コンタクト３４ａｉ（ｉ＝１～ｎ，ｎは整数）は、下部基台部３２ａに圧入されている

端子部３４Ｔと、端子部３４Ｔに連なりコンタクトシートのパッドに下方側から電気的に接続される固定側接点部３４ｆと、弾性を有し端子部３４Ｔに連なりコンタクトシートのパッドに上方側から電気的に接続される可動側接点部３４ｍと、可動側接点部３４ｍから分岐され後述するカバー部材３６の斜面部に選択的に係合されて可動側接点部３４ｍを固定側接点部３４ｆに対して離隔する方向に回動させる被係合部３４ｅとを含んで構成されている。

【００１８】

各コンタクト３４ａｉは、図７において、後述するコンタクトシート４４のパッドに対応して紙面に対し略垂直方向に沿って所定の間隔で配列されている。なお、図７においては、収容部３２Ａの四方を取り囲むコンタクト群３４のうちの一辺に対応する部分のみのコンタクト群３４を示す。

【００１９】

樹脂材料で成形されるカバー部材３６は、キャリアユニット４０が通過する開口部３６ａを有している。開口部３６ａの周縁を形成する枠状部分は、本体部３２の外周部に設けられる溝に案内される脚部により、昇降動可能に支持されている。なお、カバー部材３６は、図示が省略される弾性部材により、本体部３２に対し離隔する方向に付勢されている。その枠状部分の各辺の下端には、図７の二点鎖線で示されるように、カバー部材３６が所定位置まで下降せしめられるとき、上述の各コンタクト３４ａｉの被係合部３４ｅに係合し可動側接点部３４ｍをその弾性力に抗して固定側接点部３４ｆに対して離隔する方向に回動させる斜面部３６ｓがそれぞれ形成されている。

【００２０】

後述するキャリアユニット４０がＩＣソケット３０の本体部３２の収容部３２Ａに装着される場合、カバー部材３６が所定量、押し下げ保持されることにより、コンタクト群３４の各可動接点部３４ｍが収容部３２Ａに対し後退せしめられた後、上方から開口部３６ａを介してキャリアユニット４０が収容部３２Ａ内に位置決めされ載置される。その際、固定側接点部３４ｆは、キャリアユニット４０におけるコンタクトシート４４のパッドの下面側に当接せしめられる。

【００２１】

続いて、保持された状態のカバー部材３６が解放されるとき、上述の弾性体の復帰力、および各コンタクト３４ａｉの被係合部３４ｅの弾性力の合力によりカバー部材３６が上昇せしめられる。その際、コンタクト群３４の各可動接点部３４ｍは、元の位置に戻され、キャリアユニット４０のコンタクトシート４４のパッドの上面側に当接せしめられる。それにより、図７に示されるように、コンタクトシート４４とコンタクト群３４とが電気的に接続されることになる。

【００２２】

キャリアユニット４０は、図８に示されるように、ベアチップ６０が収容される収容部４６Ａを有するキャリアハウジング４６と、キャリアハウジング４６の収容部４６Ａの底部を形成するベース部材４２上に弾性シート５８を介して配されるコンタクトシート４４と、ベアチップ６０の電極群をコンタクトシート４４のバンプ４４Ｂに対して押圧する押圧体５６を含んでなる押圧用蓋５２と、押圧用蓋５２をキャリアハウジング４６に選択的に保持するラッチ機構５０（図７参照）とを含んで構成されている。

【００２３】

押圧用蓋５２は、図８に示されるように、ベアチップ６０の上面に当接する押圧面５６ａを有する押圧体５６と、押圧体５６の基部を収容する蓋本体６４と、押圧体５６の基部の凹部と蓋本体６４の比較的深い凹部との間の空間に配され押圧体５６をベアチップ６０に向けて付勢する複数のスプリング５４とを含んで構成されている。

【００２４】

略正方形のベアチップ６０は、例えば、所定の電極群をコンタクトシート４４のバンプに対向する下面に有している。

【００２５】

押圧体５６の基部は、蓋本体６４の比較的浅く広い凹部内に移動可能に挿入されている。その押圧体５６が挿入される部分の端部には、蓋本体６４の下端に設けられる爪部に係合される爪部５６ｎが相対向して複数個形成されている。これにより、押圧体５６がスプリング５４の付勢力で付勢された状態で蓋本体６４に保持されることとなる。

【００２６】

蓋本体６４は、その対向する両端部にそれぞれ、ラッチ機構５０のフック部材４８Ａおよび４８Ｂが係合される突起部６４ｐを有している。突起部６４ｐは、後述するように、押圧用蓋５２の装着のとき、フック部材４８Ａおよび４８Ｂの先端の傾斜面に係合し、フック部材４８Ａおよび４８Ｂを互いに離隔する方向に押圧する斜面部６４ｐｓを有している。

【００２７】

ラッチ機構５０は、キャリアハウジング４６の両端にそれぞれ、回動可能に支持され蓋本体６４を保持するフック部材４８Ａおよび４８Ｂと、フック部材４８Ａおよび４８Ｂをそれぞれ、図７において矢印の示す方向、即ち、蓋本体６４の突起部６４ｐに係合させる方向に付勢するねじりコイルばね６６と、フック部材４８Ａ、４８Ｂ、およびねじりコイルばね６６を支持する支持軸６８とを含んで構成されている。

【００２８】

キャリアハウジング４６の両端部には、押圧用蓋５２が装着されるとき、蓋本体６４の下部の外周部を案内するガイド部４６ｇが形成されている。ガイド部４６ｇの周囲には、支持軸６８の両端部が支持されている。

【００２９】

コンタクトシート４４は、図８および図９に示されるように、電気的に接続されるベアチップ６０の電極群に対応した配列で複数のバンプ４４Ｂを基材４４Ｍ内に有している。例えば、母材となる銅の表面がニッケルおよび金メッキ処理されて形成される各バンプ４４Ｂの先端は、その基材４４Ｍの表面から所定の高さだけ突出している。基材４４Ｍは、例えば、ポリイミド樹脂材料（線膨張係数：３５×１０$^{-6}$／℃）で薄板状に作られ、約４０μｍ程度の厚さを有している。

【００３０】

各バンプ４４Ｂは、図９に示されるように、銅箔で作られる導体層４４ｃを介してパッド４４ｐに接続されている。パッド４４ｐは、基材４４Ｍにおいてベース部材４２の両端部からそれぞれ、外部に向けて突出する両端部に形成されている。

【００３１】

なお、コンタクトシート４４における複数のバンプ４４Ｂの形成される部分は、ベース部材４２の表面に略平行に相対的に所定の範囲だけ移動可能に支持されている。

【００３２】

かかる構成において、キャリアユニット４０内にベアチップ６０を装着するにあたっては、先ず、ベアチップ６０の電極群がコンタクトシート４４のバンプ４４Ｂに対して位置決めされ、ベアチップ６０の電極群がバンプ４４Ｂに当接するように配置される。次に、押圧用蓋５２がキャリアハウジング４６の収容部４６Ａ内に挿入される。その際、押圧用蓋５２の蓋本体６４の斜面部６４ｐｓにより、ねじりコイルばね６６の付勢力に抗してラッチ機構５０のフック部材４８Ａおよび４８Ｂの先端が互いに離隔する方向に回動される。また、蓋本体６４の外周面がガイド部４６ｇの内面に案内されつつ、押圧体５６の押圧面５６ａがスプリング５４の付勢力に抗してベアチップ６０の上面に押し付けられる。

【００３３】

続いて、ねじりコイルばね６６より付勢されることにより、フック部材４８Ａおよび４８Ｂの先端が互いに近接する方向に回動され蓋本体６４の突起部６４ｐに係合される。その結果、押圧用蓋５２がキャリアハウジング４６に保持されることとなる。

【００３４】

そして、そのキャリアユニット４０が上述したように収容部３２Ａに装着された状態でベアチップ６０に対し所定の雰囲気中で試験が実行されることとなる。

【００３５】
そのような試験にあたり、上述のようなコンタクトシート４４は、所定数の装着される新たなベアチップ６０に対し繰り返し利用されることとなる。
【００３６】
このような試験に供される以前、各バンプ４４Ｂは、当初、図５（Ａ）に拡大されて示されるように、略円錐状の形状を有している。また、バンプ４４Ｂの最先端部には、図６（Ａ）に拡大されて示されるように、微小な凹凸４４ａがその表面全体に形成されている。
【００３７】
次に、コンタクトシート４４が試験に供されるとき、図５（Ｂ）および図６（Ｂ）に拡大されて示されるように、バンプ４４Ｂの最先端部は、所定の潰し代をもって所定の圧力でベアチップ６０の電極面に、当接されることとなる。
【００３８】
続いて、一枚のコンタクトシート４４が所定数のベアチップ６０に対し繰り返し利用されることにより、図５（Ｃ）および図６（Ｃ）に拡大されて示されるように、各バンプ４４Ｂ’の最先端部は、押し潰され、平坦面を有する略円錐台形状となる。そのような各バンプ４４Ｂ’の平滑な平坦面４４ｆｓは、図６（Ａ）に示されるような微小な凹凸を有していないものとなる。
【００３９】
従って、一枚のコンタクトシート４４が交換されることなく所定回数以上使用される場合、コンタクトシート４４およびベアチップ６０相互間の電気的接続が不確実となる虞がある。
【００４０】
そこで、本発明に係る電極の回復処理方法の第１実施例においては、予め、図１（Ａ）に示されるような、所定の厚さを有する転写板１０が用意される。その転写板１０は、例えば、表面処理としてクロム（線膨張係数：約６．２×１０$^{-6}$／℃）でメッキ処理した冷間工具鋼（ＪＩＳ記号　ＳＫＳ，ＳＫＤ）（線膨張係数：約１１．５×１０$^{-6}$／℃）で作られ、少なくとも一方側の転写面１０ｓに、図２（Ａ）に拡大されて示されるように、所定の粗さの凹凸１０ａを有している。
【００４１】
先ず、図１（Ａ）に示されるように、バンプが摩耗したコンタクトシート４４が、配置されるとともに、ベアチップ６０の代わりに転写板１０が装着された上述のキャリアユニット４０が所定の室内温度を維持する恒温槽１２内に配置される。恒温槽１２は、室内の温度を可変に調整できる温度調整器を備えるものとされる。
【００４２】
その際、転写板１０は、その転写面１０ｓが恒温槽１２内の各バンプ４４Ｂ’の摩耗した平坦面４４ｆｓに接触するように複数の平坦面４４ｆｓにより形成される共通平面上に載置される。従って、転写板１０は、複数のバンプ４４Ｂ’の平坦面４４ｆｓにより支持されることとなる。その際、押圧体５６を介してスプリング５４の付勢力により、図１（Ａ）に示される矢印Ｆの示す方向に沿って所定の圧力で加圧される。その加圧力は、例えば、１個のバンプ４４Ｂあたり約１ｇ以上１００ｇ以下の範囲に設定されている。本願の発明者による検証によれば、加圧力が１個のバンプ４４Ｂあたり約１ｇ未満の場合、回復処理の効果が殆どなく、また、加圧力が１個のバンプ４４Ｂあたり１００ｇを越える場合、バンプ４４Ｂの突出高さが基準よりも低くなりすぎ、かつ、バンプ４４Ｂの先端の潰れが比較的大となることにより、被検査物の電極に比較的大きな損傷を及ぼすという問題が生じることが確認されたのでその加圧力は、例えば、１個のバンプ４４Ｂあたり約１ｇ以上１００ｇ以下の範囲に設定されている。
【００４３】
図３（Ｂ）は、転写面１０ｓが平坦面４４ｆｓに接触し加圧された直後のバンプ４４Ｂ’の先端部の状態を拡大して示す。これにより、図３（Ｂ）から明らかなように、バンプ４４Ｂ’の先端部は、転写板１０の凹凸１０ａにより押圧され比較的粗い凹凸４４ｐｓが形

成されることとなる。

【００４４】

次に、恒温槽１２内の温度が例えば、標準状態から８０℃以上から１５０℃までの範囲に上昇せしめられ、５分以上維持される。なお、恒温槽１２内の温度および維持する期間は、好ましくは、室温１５０℃で１５分程度に設定される。

【００４５】

従って、転写板１０およびコンタクトシート４４は、それぞれ、室温の温度上昇につれて例えば、図１（Ａ）の矢印Ｅの示す方向に膨張した場合においては、基材４４Ｍの熱膨張係数は、上述したように転写板１０の線膨張係数よりも大に設定されているのでコンタクトシート４４は、図３（Ｂ）に示される凹凸４４ｐｓと転写面１０ｓとの相互間の摩擦力に抗して転写板１０の伸びに比して相対的に大に延びることとなる。その結果、凹凸４４ｐｓが形成される面は、コンタクトシート４４およびバンプ４４Ｂ’の転写面１０ｓの微小な凹凸１０ａに対する数十μｍ程度の相対的な摺動によりさらに削られ、図３（Ｃ）に示されるような、その表面粗さがより細かな粗さの凹凸４４ｍｓが形成されることとなる。

【００４６】

続いて、回復処理されたバンプ４４Ｂ”を有するコンタクトシート４４”が図１（Ｂ）に示されるように、キャリアユニット４０から取り出される。

【００４７】

従って、図２（Ｂ）および図３（Ｄ）に拡大されて示されるように、バンプ４４Ｂ”の最先端の面４４ｅｓには、比較的大きな押圧力を加えることなく、転写板１０における転写面１０ｓの微小な凹凸１０ａの押圧および摺動に対応した比較的微細な凹凸４４ｍｓが形成されることとなる。

【００４８】

また、上述のように、加熱することにより、バンプ４４Ｂが変形し易くなるので上述の凹凸の形成がより容易となる。

【００４９】

図４（Ａ）、（Ｂ）、（Ｃ）は、それぞれ、本願発明の発明者により検証された比較例におけるバンプ４４Ｂ’の各工程の状態を示す。

【００５０】

その比較例においては、電極の回復処理を行うにあたり、上述の例のように加熱されることなく、上述のキャリアユニット４０内に、上述の例と同様に図４（Ａ）に拡大されて示されるような、バンプ４４Ｂ’が摩耗したコンタクトシート４４が配され、かつ、上述のようにベアチップ６０の代わりに同様な転写板１０が装着されるだけのものとされる。

【００５１】

斯かる比較例においては、押圧体５６を介してスプリング５４の付勢力により、図１（Ａ）に示される矢印Ｆの示す方向に沿って上述の例と同様な所定の圧力でバンプ４４Ｂ’が転写板１０により加圧される。図４（Ｂ）は、転写面１０ｓが平坦面４４ｆｓに接触し加圧された直後のバンプ４４ＢＣの先端部の状態を拡大して示す。これにより、図４（Ｂ）から明らかなように、バンプ４４ＢＣの先端部は、転写板１０の凹凸１０ａにより押圧され比較的粗い凹凸４４ｐｓが形成されることとなる。

【００５２】

次に、回復処理されたバンプ４４ＢＣを有するコンタクトシートが、キャリアユニット４０から取り出される。

【００５３】

従って、図４（Ｃ）に拡大されて示されるように、バンプ４４ＢＣの最先端の面には、転写板１０における転写面１０ｓの微小な凹凸１０ａの押圧に対応した比較的粗い凹凸４４ｐｓが形成されることとなる。

【００５４】

その結果、比較例の方法においては、本願の実施例１において得られるような比較的微細

な凹凸４４ｍｓが形成されないことが確認された。

【００５５】

加えて、本願発明においては、上述したような転写面１０ｓとバンプ４４Ｂとの間の相対的な摺動により、バンプ４４Ｂの接続面にヤスリをかけたような効果が得られ、しかも、押圧だけにより転写を行う場合に比してその凹凸の間隔がより狭くかつ凹凸が確実に形成されることとなる。

【００５６】

図１０（Ａ）、（Ｂ）、（Ｃ）は、本発明に係る電極の回復処理方法の第２の実施例における各工程を模式的に示す。

【００５７】

図１０（Ａ）～（Ｃ）に示される例に用いられるコンタクトシート８０は、図１０（Ａ）に示されるように、電気的に接続されるベアチップ６０の電極群に対応した配列で複数のバンプ８４Ｂを基材８４Ｍ内に有している。その各バンプ８４Ｂの先端は、その基材８４Ｍの表面から所定の高さだけ突出している。その先端の表面全体には、図１１（Ａ）に拡大されて示されるように、微小な凹凸８４ａが形成されている。

【００５８】

各バンプ８４Ｂは、銅箔で作られる導体層８４Ｃを通じてパッド（不図示）に電気的に接続されている。そのパッドは、基材８４Ｍにおいて上述のようなベース部材４２の両端部からそれぞれ、外部に向けて突出する両端部に形成されている。各バンプ８４Ｂは、例えば、母材となる金（ヌープ硬度：８０～２００）または銅（ヌープ硬度：２５０～３２０）に所定の結晶物８６が略均一に混合された材料で略円錐状に形成されている。

【００５９】

結晶物８６は、母材が金の場合、金の硬度よりも大なる硬度を有し比較的電気伝導度の高い約２～３μｍの粒子径のパラジュウム（Ｐｄ）（ヌープ硬度：２５０～３５０）で作られ、約１５～２０％／ｖｏｌ程度の含有率で混合されている。

【００６０】

また、結晶物８６は、母材が銅の場合、銅の硬度よりも大なる硬度を有し比較的電気伝導度の高い約２～３μｍの粒子径のニッケル（Ｎｉ）（ヌープ硬度：３００～４９０）で作られ、約１５～２０％／ｖｏｌ程度の含有率で混合されている。

【００６１】

基材８４Ｍは、例えば、ポリイミド樹脂材料（線膨張係数：３５×10^{-6}／℃）で薄板状に作られ、約４０μｍ程度の厚さを有している。

【００６２】

斯かるコンタクトシート８０の電極としてのバンプ８４Ｂを回復処理するにあたっては、一枚のコンタクトシート８０が上述のキャリアユニット４０内に上述のように配置されるもとで、ベアチップ６０に対し繰り返し利用されることによりバンプ８４Ｂの先端の接続面が自動的に回復処理されることとなる。従って、上述の第１実施例において用いられている転写板１０の押圧工程および加熱工程が不要とされる。

【００６３】

即ち、キャリアユニット４０内のコンタクトシート８０が試験に供されるとき、図１０（Ｂ）および図１１（Ｂ）に拡大されて示されるように、バンプ８４Ｂの最先端部は、所定の潰し代をもって所定の圧力でベアチップ６０の電極面に、当接されることとなる。

【００６４】

続いて、一枚のコンタクトシート８０が所定数のベアチップ６０に対し繰り返し利用されることにより、図１０（Ｃ）および図１１（Ｃ）に拡大されて示されるように、各バンプ８４Ｂ’の最先端部は、押し潰され、略平坦な面を有する略円錐台形状となる。そのような各バンプ８４Ｂ’の先端面８４ｆｓには、図１１（Ｃ）に示されるように、母材の摩耗によって含有される複数の結晶物８６の一部が露出することにより、微小な凹凸が形成されることとなる。

【００６５】

従って、新たな微小な凹凸のある面が、各バンプ８４Ｂ’の最先端部の母材の摩耗に伴ない、各バンプ８４Ｂ’の最先端部に自動的に形成されることとなる。

【００６６】

上述の本発明に係る電極の回復処理方法の第１の実施例に用いられるキャリアユニット４０においては、コンタクトシート４４における複数のバンプ４４Ｂの形成される部分は、ベース部材４２の表面に略平行に相対的に所定の範囲だけ移動可能に支持されている。

【００６７】

しかしながら、キャリアユニット４０の構造は、必ずしもこのようになされる必要がなく、例えば、図１２（Ａ）および（Ｂ）～図１４（Ａ）および（Ｂ）に示されるキャリアユニットが用いられても良い。

【００６８】

図１２（Ａ）において、キャリアユニットは、上述の例と同様に、ベアチップ６０または転写板１０が収容される収容部４７Ａを有するキャリアハウジング４７と、キャリアハウジング４７の収容部４７Ａの底部を形成するベース部材４３と、ベース部材４３上に弾性シート４１を介して配されるコンタクトシート４５と、ベアチップ６０の電極群または転写板１０をコンタクトシート４５のバンプ４５Ｂに対して押圧する押圧体を含んでなる押圧用蓋５２と、押圧用蓋５２をキャリアハウジング４７に選択的に保持するラッチ機構４９とを含んで構成されている。なお、押圧用蓋５２およびラッチ機構４９の構造は、上述の第１の実施例における押圧用蓋およびラッチ機構の構造と同一なのでその重複説明を省略する。

【００６９】

キャリアハウジング４７は、上述の転写板１０の線膨張率よりも大なる線膨張率を有する材料、例えば、樹脂材料により成形されている。樹脂材料としては、例えば、ポリエーテルイミド（線膨張係数：５６×１０$^{-6}$／℃）が望ましい。キャリアハウジング４７の収容部４７Ａの内周部は、図１２（Ｂ）に示されるように、押圧用蓋５２が装着されるとき、押圧用蓋５２の外周部を案内し所定位置に位置決めするように形成されている。キャリアハウジング４７の収容部４７Ａの底面部には、中央の開口部４７ｂの周囲に後述する締結部材５１が挿入される孔４７ａが４箇所に形成されている。

【００７０】

コンタクトシート４５は、電気的に接続されるベアチップ６０の電極群に対応した配列で複数のバンプ４５Ｂを基材４５Ｍ内に有している。例えば、母材となる銅の表面がニッケルおよび金メッキ処理されて形成される各バンプ４５Ｂの先端は、その基材４５Ｍの表面から所定の高さだけ突出している。基材４５Ｍは、例えば、ポリイミド樹脂材料（線膨張係数：３５×１０$^{-6}$／℃）で薄板状に作られ、約４０μｍ程度の厚さを有している。

【００７１】

各バンプ４４Ｂは、銅箔で作られる導体層を介してパッド４５ｐに接続されている。複数のパッド４５ｐは、基材４５Ｍにおいてベース部材４３の両端部からそれぞれ、外部に向けて突出する両端部に形成されている。

【００７２】

コンタクトシート４５は、キャリアハウジング４７の孔４７ａに対応して締結部材５１が挿入される孔４５ａを複数のバンプ４４Ｂの周辺に有している。

【００７３】

ベース部材４３は、キャリアハウジング４７の材料と同一材料により成形されており、キャリアハウジング４７の孔４７ａおよびコンタクトシート４５の孔４５ａに対応して孔４３ａを有している。

【００７４】

コンタクトシート４５の複数のバンプ４４Ｂの真下に配される弾性シート４１が果たす役割のひとつは、上述の例と同様に各バンプ４５Ｂの突出高さに起因するバンプ４５Ｂの接触力のばらつきを均一にすることである。

【００７５】

図１２（Ｂ）に示されるように、コンタクトシート４５を挟んでキャリアハウジング４７とベース部材４３とを互いに締結する締結部材５１としては、例えば、リベット、または、ビスおよびナットが好ましい。

【００７６】

このようなキャリアユニットが用いられるとき、バンプの回復処理にあたっては、上述の第１の実施例と同様に、先ず、バンプが摩耗したコンタクトシート４５が、配置されるとともに、ベアチップ６０の代わりに転写板１０が装着された上述のキャリアユニットが所定の室内温度を維持する恒温槽１２内に配置される。

【００７７】

押圧力の条件は、上述の第１の実施例と同様に設定される。

【００７８】

次に、恒温槽１２内の温度が例えば、標準状態から８０℃以上から１５０℃までの範囲に上昇せしめられ、５分以上維持される。なお、恒温槽１２内の温度および維持する期間は、好ましくは、室温１５０℃で１５分程度に設定される。

【００７９】

従って、転写板１０と、ベース部材４３、キャリアハウジング４７およびコンタクトシート４５とは、それぞれ、室温の温度上昇につれて膨張した場合においては、キャリアハウジング４７等の線膨張係数は、上述したように転写板１０の線膨張係数よりも大に設定されているのでコンタクトシート４５は、転写面１０ｓとの相互間の摩擦力に抗して転写板１０の伸びに比して相対的に大に延びることとなる。その結果、上述の第１の実施例と同様に、その表面粗さがより細かな粗さの凹凸が各バンプ４５Ｂの先端に形成されることとなる。

【００８０】

図１３（Ａ）および（Ｂ）は、それぞれ、本発明に係る電極の回復処理方法の一例に用いられる他のキャリアユニットを示す。

【００８１】

図１２（Ａ）および（Ｂ）に示されるキャリアユニットにおいては、締結部材５１により、コンタクトシート４５を挟んでキャリアハウジング４７とベース部材４３とが互いに締結されているが、その代わりに、図１３（Ａ）および（Ｂ）においては、接着剤または融接により、コンタクトシート４５を挟んでキャリアハウジング４７とベース部材４３とが互いに接合される。なお、図１３（Ａ）および（Ｂ）においては、図１２（Ａ）および（Ｂ）において同一とされる構成要素について同一の符号を付して示し、その重複説明を省略する。

【００８２】

キャリアハウジング４７’は、上述の転写板１０の線膨張率よりも大なる線膨張率を有する材料、例えば、樹脂材料により成形されている。樹脂材料としては、例えば、ポリエーテルイミド（線膨張係数：５６×10^{-6}／℃）が望ましい。キャリアハウジング４７’の収容部４７’Ａの内周部は、図１３（Ｂ）に示されるように、押圧用蓋５２が装着されるとき、押圧用蓋５２の外周部を案内し所定位置に位置決めするように形成されている。キャリアハウジング４７’の収容部４７’Ａの底面を形成する底面部には、中央に開口部４７’ｂが形成されている。

【００８３】

ベース部材４３’は、キャリアハウジング４７’の材料と同一材料により成形されており、コンタクトシート４５の孔４５ａにそれぞれ対応して位置決めピン４３’Ｐを４箇所に有している。位置決めピン４３’Ｐは、弾性シート４１が配される面に対して所定の長さ、例えば、コンタクトシート４５の厚さ程度だけ突出している。位置決めピン４３’Ｐは、コンタクトシート４５のベース部材４３’に対する相対位置を位置決めするとともに、ベース部材４３’の熱膨張または収縮の変位に応じてコンタクトシート４５を同様に変位させるためのものとされる。ベース部材４３’のキャリアハウジング４７’の収容部４７’Ａに対する相対位置は、融接のとき、位置決めされる。

【００８４】
斯かる例においても、転写板１０と、ベース部材４３’、キャリアハウジング４７’およびコンタクトシート４５とは、それぞれ、室温の温度上昇につれて膨張した場合においては、キャリアハウジング４７’等の線膨張係数は、上述したように転写板１０の線膨張係数よりも大に設定されているのでコンタクトシート４５は、転写面１０ｓとの相互間の摩擦力に抗して転写板１０の伸びに比して相対的に大に延びることとなる。その結果、上述の第１の実施例と同様に、その表面粗さがより細かな粗さの凹凸が各バンプ４５Ｂの先端に形成されることとなる。
【００８５】
図１４（Ａ）および（Ｂ）は、それぞれ、本発明に係る電極の回復処理方法の一例に用いられるさらなる他のキャリアユニットを示す。
【００８６】
図１３（Ａ）および（Ｂ）に示されるキャリアユニットにおいては、コンタクトシート４５を挟んでキャリアハウジング４７’と位置決めピン４３’Ｐを有するベース部材４３’とが互いに接合されているが、その代わりに、図１４（Ａ）および（Ｂ）においては、接着剤または融接により、コンタクトシート４５を挟んで位置決めピン４７”Ｐを有するキャリアハウジング４７”とベース部材４３”とが互いに接合されるものとされる。なお、図１４（Ａ）および（Ｂ）においては、図１２（Ａ）および（Ｂ）において同一とされる構成要素について同一の符号を付して示し、その重複説明を省略する。
【００８７】
キャリアハウジング４７”は、上述の転写板１０の線膨張率よりも大なる線膨張率を有する材料、例えば、樹脂材料により成形されている。樹脂材料としては、例えば、ポリエーテルイミド（線膨張係数：５６×１０$^{-6}$／℃）が望ましい。キャリアハウジング４７”の収容部４７”Ａの内周部は、図１４（Ｂ）に示されるように、押圧用蓋５２が装着されるとき、押圧用蓋５２の外周部を案内し所定位置に位置決めするように形成されている。キャリアハウジング４７”の収容部４７”Ａの底面部には、中央に開口部４７”ｂが形成されている。開口部４７”ｂの周辺の外面には、コンタクトシート４５の孔４５ａにそれぞれ対応して位置決めピン４７”Ｐが４箇所に突出している。位置決めピン４７”Ｐは、その底面に対して所定の長さ、例えば、コンタクトシート４５の厚さ程度だけ突出している。位置決めピン４７”Ｐは、コンタクトシート４５のキャリアハウジング４７”に対する相対位置を位置決めするとともに、キャリアハウジング４７”の熱膨張または収縮の変位に応じてコンタクトシート４５を同様に変位させるためのものとされる。キャリアハウジング４７”の収容部４７’Ａのベース部材４３”に対する相対位置は、融接のとき、位置決めされる。
【００８８】
ベース部材４３”は、キャリアハウジング４７”の材料と同一材料により成形されている。
【００８９】
斯かる例においても、転写板１０と、ベース部材４３”、キャリアハウジング４７”およびコンタクトシート４５とは、それぞれ、室温の温度上昇につれて膨張した場合においては、キャリアハウジング４７”等の線膨張係数は、上述したように転写板１０の線膨張係数よりも大に設定されているのでコンタクトシート４５は、転写面１０ｓとの相互間の摩擦力に抗して転写板１０の伸びに比して相対的に大に延びることとなる。その結果、上述の第１の実施例と同様に、その表面粗さがより細かな粗さの凹凸が各バンプ４５Ｂの先端に形成されることとなる。
【００９０】
図１５および図１６は、それぞれ、本発明に係る電極の回復処理方法の第３の実施例に用いられるキャリアユニットステージの構成を、転写板固定ヘッドとともに概略的に示す。
【００９１】
なお、図１５および図１６においては、図７および図８に示される例におけるキャリアユ

ニットにおいて同一とされる構成要素について同一の符号を付して示し、その重複説明を省略する。また、図１５および図１６においては、押圧用蓋が取り外された状態のキャリアユニットの一部の構成要素がキャリアユニットステージ内に保持された状態を示す。

【００９２】

キャリアユニットは、その一部が図１５および図１７に示されるように、ベアチップ６０が収容される収容部１１６Ａを有するキャリアハウジング１１６と、キャリアハウジング１１６の収容部１１６Ａの底部を形成するベース部材１０８上に弾性シート１１０を介して配されるコンタクトシート４４と、ベアチップ６０の電極群をコンタクトシート４４のバンプ４４Ｂに対して押圧する押圧体を含んでなる押圧用蓋と（不図示）、その押圧用蓋をキャリアハウジング１１６に選択的に保持するラッチ機構１１６Ｆとを含んで構成されている。

【００９３】

なお、図示されていない上述の押圧用蓋は、図８に示される例における構成と同様な構成を備えている。

【００９４】

ラッチ機構１１６Ｆは、図７に示されるようなキャリアハウジング１１６の両端にそれぞれ、支持軸により回動可能に支持され押圧用蓋の端部を保持するフック部材と、フック部材をそれぞれ、押圧用蓋の端部に係合させる方向に付勢するコイルスプリングと、を含んで構成されている。

【００９５】

キャリアユニットステージ１０６は、コンタクトシート４４のバンプ４４Ｂの回復処理にあたり、キャリアハウジング１１６を一時的に収容する収容部１０６Ａを有している。上方に向けて開口する収容部１０６Ａの内周部は、図１５および図１７に示されるように、ベース部材１０８の収容部１０６Ａに対する相対位置を規制するためにベース部材１０８の端部に係合するように形成されている。

【００９６】

収容部１０６Ａの周縁部には、図１６および図１７に示されるように、キャリアユニットのキャリアハウジング１１６を収容部１０６Ａ内に着脱可能に保持する一対のラッチ機構が相対向して設けられている。そのラッチ機構は、キャリアユニットステージ１０６における収容部１０６Ａを形成する壁部にそれぞれ、支持軸１１８により回動可能に支持されキャリアハウジング１１６の収容部１１６Ａの周縁部を保持するフック部材１１２と、フック部材１１２をそれぞれ、収容部１１６Ａの周縁部に係合させる方向に付勢するコイルスプリング１１４と、を含んで構成されている。

【００９７】

フック部材１１２は、キャリアユニットのキャリアハウジング１１６だけが収容部１０６Ａ内に装着されるとき、または、収容部１０６Ａから取り外されるとき、図１７に二点鎖線で示されるように、その一端がコイルスプリング１１４の付勢力に抗して収容部１０６Ａ内から離隔するように回動される。一方、フック部材１１２の一端は、キャリアハウジング１１６が収容部１０６Ａ内に保持されるとき、図１５および図１７に示されるように、コイルスプリング１１４の付勢力によりキャリアハウジング１１６の収容部１１６Ａの周縁部に当接される。

【００９８】

転写板固定ヘッドは、後述するように、バンプが摩耗したコンタクトシート４４について回復処理が行なわれるとき、図１５に示されるように、キャリアユニットにおけるキャリアハウジング１１６の収容部１１６Ａ内に配置される。

【００９９】

転写板固定ヘッドは、図１５に示されるように、転写板１０４が固定される固定面１０２ａを有する押圧体１０２と、押圧体１０２の基部を収容する凹部を有する蓋本体１００と、押圧体１０２の基部の凹部と蓋本体１００の比較的深い凹部との間の各空間にそれぞれ配され転写板１０４をコンタクトシート４４のバンプ４４Ｂに向けて付勢する複数のスプ

リング１０３とを含んで構成されている。

【０１００】

押圧体１０２の基部は、蓋本体１００の比較的浅く広い凹部内に移動可能に挿入されている。その押圧体１０２が挿入される部分の端部には、蓋本体１００の下端に設けられる爪部に係合される爪部１０２ｎが相対向して複数個形成されている。これにより、押圧体１０２が複数のスプリング１０３の付勢力で付勢された状態で蓋本体１００に保持されることとなる。

【０１０１】

金属材料またはセラミック材料等で作られる転写板１０４の一方の面は、固定面１０２ａに対し接着または締結具により固定されている。転写板１０４の他方の面には、所定の平面度および所定の表面粗さを有した凹凸が形成されている。なお、転写板１０４は、斯かる例に限られることなく、押圧体１０２と一体に形成されてもよい。また、押圧体１０２は、複数のスプリング１０３が介在されることなく、例えば、蓋本体１００と一体に形成されてもよい。

【０１０２】

一方、キャリアユニットの押圧用蓋（不図示）は、ベアチップ６０に対し試験が実行されるとき、キャリアハウジング１１６にそのラッチ機構１１６Ｆにより保持される。

【０１０３】

蓋本体１００の上部の略中央部には、後述するロードセルの雄ねじ部がはめ合わされる雌ねじ部１００ｓが設けられている。

【０１０４】

図１８は、コンタクトシート４４のバンプ４４Ｂについての回復処理の工程において、転写板固定ヘッドに対しコンタクトシート４４を相対的に移動させる摺動装置の全体構成を概略的に示す。

【０１０５】

摺動装置は、ベース部材１２０上に配されコンタクトシート４４が収容されるキャリアハウジング１１６を保持するキャリアユニットステージ１０６を固定するとともに所定の方向に移動させるテーブル機構部と、転写板固定ヘッドを保持し所定の圧力を転写板１０４およびコンタクトシート４４のバンプ４４Ｂに作用させる加圧機構部とを含んで構成されている。

【０１０６】

テーブル機構部は、ベース部材１２０上に配される基台１２２と、基台１２２に支持されるボールネジ部材１２４により移動されるＸ軸方向ステージ部材１２６と、ボールネジ部材１２４の軸線方向に略直交する方向に沿ってＸ軸方向ステージ部材１２６に支持されるボールネジ部材１３２により移動されるＹ軸方向ステージ部材１３０と、Ｙ軸方向ステージ部材１３０に配されるステージ支持部１３４に回動可能に支持されキャリアユニットを保持する回転ステージ１３６とを含んで構成されている。

【０１０７】

基台１２２は、図１８における矢印Ｘの示す方向に沿って形成される平坦部と、平坦部に対し略垂直に矢印Ｚの示す方向に広がり延在する倒立面部とからなる。

【０１０８】

Ｘ軸方向ステージ部材１２６は、ガイドレール１６８により案内され、かつ、ナットを介してボールネジ部材１２４により移動可能に支持されている。ボールネジ部材１２４の両端部は、それぞれ基台１２２の平坦部における図１８において矢印Ｘの示す方向に沿った端部により支持されている。ボールネジ部材１２４の一方の端部には、遊星歯車機構等の減速機構１６０ＧＨを介して基台１２２に固定される駆動モータ１６０の出力軸が連結されている。なお、駆動モータ１６０は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。駆動モータ１６０および後述する各駆動モータは、後述する制御ユニット１５０により制御される。

【０１０９】

Ｙ軸方向ステージ部材１３０は、Ｘ軸方向ステージ部材１２６の内周部に一対対向配置されるガイドレール１２８Ａおよび１２８Ｂにより紙面に垂直方向に沿って移動可能に支持されている。また、Ｙ軸方向ステージ部材１３０は、ナットを介してボールネジ部材１３２により移動可能に支持されている。ボールネジ部材１３２の両端部は、それぞれＸ軸方向ステージ部材１２６における図１８において紙面に垂直方向に沿った端部により支持されている。ボールネジ部材１３２の一方の端部には、遊星歯車機構等の減速機構を介してＸ軸方向ステージ部材１２６に固定される駆動モータ１６２の出力軸が連結されている。駆動モータ１６２は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。

【０１１０】

Ｙ軸方向ステージ部材１３０の上面に固定されるステージ支持部１３４の中央部には、駆動モータ１６４が固定されている。ステージ支持部１３４は、Ｘ軸方向ステージ部材１２６の切欠きを介してＹ軸方向ステージ部材１３０の上面に固定されている。駆動モータ１６４の出力軸には、減速機構１６４ＧＨを介して回転ステージ１３６の円板部の中央の内側に連結されている。回転ステージ１３６の側壁は、ベアリング１３７を介して回動可能にステージ支持部１３４の上部に支持されている。駆動モータ１６４は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。

【０１１１】

これにより、回転ステージ１３６は、駆動モータ１６４が作動状態とされるとき、Ｙ軸方向ステージ部材１３０の中心軸線およびステージ支持部１３４の中心軸線回りに回動されることとなる。

【０１１２】

キャリアユニットステージ１０６は、図示が省略される締結部材、例えば、ねじ部材等により回転ステージ１３６の円板部に対し固定されている。

【０１１３】

加圧機構部は、転写板固定ヘッドを介してバンプ４４Ｂに対する押圧力を検出するロードセル１３８と、ロードセル１３８を保持するとともに押圧力を転写板固定ヘッドに伝達するＺ軸方向ステージ部材１４０と、Ｚ軸方向ステージ部材１４０にはめ合わされ移動可能に支持するボールネジ部材１４２と、ボールネジ部材１４２を回動させる駆動モータ１６６とを含んで構成されている。

【０１１４】

ボールネジ部材１４２の両端部は、それぞれ、倒立面部に所定の間隔をもって設けられる一対のブラケット部に回動可能に支持されている。ボールネジ部材１４２の一方の端部は、減速機構１６６ＧＨを介して倒立面部に固定される駆動モータ１６６の出力軸に連結されている。駆動モータ１６６は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。

【０１１５】

Ｚ軸方向ステージ部材１４０は、ナットを介してボールネジ部材１４２がその軸線に対し略垂直となるように嵌め合わされており、かつ、自転しないようにガイドレール１４４により案内されている。

【０１１６】

ロードセル１３８は、内部のセンサ部に連結される雄ねじ部１３８ｓが転写板固定ヘッドの雌ねじ部１００ｓにねじ込まれることにより、蓋本体１００に連結されている。ロードセル１３８は、Ｚ軸方向ステージ部材１４０の転写板固定ヘッドに対する押圧力を検出し押圧力をあらわす検出信号Ｓｐを制御ユニット１５０に送出する。

【０１１７】

制御ユニット１５０には、図示が省略される生産管理用のホストコンピュータからの各ステージ部材の位置を所定の基準位置に戻す命令をあらわすリセット指令信号Ｓｒ、キャリアハウジング１１６の移動すべき方向をあらわす移動方向指令信号Ｓｄ、回復処理開始指令信号Ｓｓ、および、上述のロードセル１３８からの検出信号Ｓｐが供給される。

【０１１８】
また、制御ユニット１５０は、コンタクトシート４４に応じて設定される転写板固定ヘッドに対する押圧力の設定値、または、キャリアハウジング１１６（キャリアユニットステージ１０６）の移動量の設定値をあらわすデータ、回復処理を実行するためのプログラムデータ等が格納されるメモリ部１５０を内部に備えている。
【０１１９】
その押圧力の値は、バンプ４４Ｂの大きさに応じて設定され、例えば、１つの電極あたり１ｇ以上１００ｇ以下の範囲とされる。押圧力の値における下限の範囲の一例としては、１つの電極あたり１ｇ以上４０ｇ以下の範囲とされる。
【０１２０】
キャリアハウジング１１６（キャリアユニットステージ１０６）の一方向の移動量は、各機構の遊びおよびコンタクトシート４４の撓み等が加味され設定され、例えば、バンプ４４Ｂの相対的な移動量が１μｍ以上１ｍｍ以下の範囲となるように設定される。バンプ４４Ｂの相対的な移動量における下限の範囲の一例としては、１μｍ以上１００μｍ以下の範囲とされる。
【０１２１】
本発明に係る電極の回復処理方法における第３の実施例による回復処理にあたり、先ず、図１８に示されるように、バンプが摩耗したコンタクトシート４４が配置されるキャリアハウジング１１６が取付けられたキャリアユニットステージ１０６が、所定の基準位置にある回転ステージ１３６の円板部に保持される。
【０１２２】
次に、制御ユニット１５０は、回復処理開始指令信号Ｓｓ、移動方向指令信号Ｓｄおよびメモリ部１５０内のデータに基づいてキャリアハウジング１１６およびキャリアユニットステージ１０６の移動量が所定の値となるように各ステージ部材の移動量を設定する。
【０１２３】
その際、制御ユニット１５０は、検出信号Ｓｐおよびメモリ部１５０ｍ内の押圧力の設定値のデータに基づいてＺ軸ステージ１４０の移動量を設定する。
【０１２４】
制御ユニット１５０は、設定された移動量に応じてパルス制御信号Ｃｚを形成しモータ駆動回路１５８に供給する。モータ駆動回路１５８は、パルス制御信号Ｃｚに基づいて駆動信号を供給するものとされる。
【０１２５】
続いて、制御ユニット１５０は、設定された移動量に応じて少なくとも１回だけキャリアハウジング１１６およびキャリアユニットステージ１０６を移動させるべく、パルス制御信号Ｃｘ、Ｃｙ，Ｃｒを形成し、それぞれ、モータ駆動回路１５２、１５４、および１５６に供給する。モータ駆動回路１５２、１５４、および１５６は、それぞれ、パルス制御信号Ｃｘ、Ｃｙ，Ｃｒに基づいて駆動モータ１６０，１６２，および１６４に対し駆動信号を供給するものとされる。
【０１２６】
これにより、キャリアハウジング１１６内のコンタクトシート４４のバンプ４４Ｂは、転写板１０４に対して相対的に所定の方向に所定量だけ１回、移動せしめられることとなる。
【０１２７】
従って、上述の第１の実施例の場合と同様に比較的大きな押圧力を加えることなく、転写板１０４における転写面の微小な凹凸の押圧および摺動に対応した比較的微細な凹凸がバンプの摩耗した端部に形成されることとなる。その凹凸は、例えば、約０．１μｍ以上５０μｍ以下程度の間隔で、約０．００１μｍ以上５μｍ以下の高さで形成される。その凹凸の下限の範囲としては、例えば、約０．１μｍ以上５０μｍ以下程度の間隔で、約０．００２μｍ以上３μｍ以下の高さの範囲とされる。
【０１２８】

また、本実施例においては、第１の実施例の場合のように加熱する必要がないので回復処理における摺動量の制御が容易であり、かつ、比較的短期間で処理でき、その結果、より量産性に適している。

【０１２９】

そして、制御ユニット１５０は、押圧力を解除すべく、パルス制御信号Ｃｚを形成しモータ駆動回路１５８に供給する。

【０１３０】

回復処理されたコンタクトシートが収容されるキャリアハウジング１１６は、キャリアユニットステージ１０６から取り外される。その際、制御ユニット１５０は、供給される制御信号Ｓｒに基づいて各ステージ部材の位置を所定の基準位置に戻すべく制御パルス信号Ｃｘ、Ｃｙ，Ｃｒ、およびＣｚを形成しそれらをモータ駆動回路１５２、１５４，１５６、１５８に供給する。

【０１３１】

取り外されたキャリアハウジング１１６は、ベアチップ６０および押圧用蓋が装着された後、上述の例と同様にキャリアユニットとしてＩＣソケット３０の収容部に装着されることとなる。

【０１３２】

【発明の効果】

以上の説明から明らかなように、本発明に係る電極の回復処理方法によれば、第１の工程において電極部の接続面に載置された転写板を所定の圧力で電極部の接続面に向けて押圧しつつ、転写板および電極板を所定温度で所定期間、加熱するのでその膨張差によって相対的に摺動されることにより電極の接続面が所定の粗さに削られるので摩耗した電極板の電極部の接続面に容易にかつ確実に所定の凹凸を形成することができる。

【図面の簡単な説明】

【図１】（Ａ），（Ｂ）は、それぞれ、本発明に係る電極の回復処理方法の第１実施例の各工程を模式的に示す図である。

【図２】（Ａ）は、図１（Ａ）に示される工程におけるバンプの先端部が部分的に拡大して示され、各工程の説明に供される部分断面図であり、（Ｂ）は、図１（Ｂ）に示される工程におけるバンプの先端部が部分的に拡大して示され、各工程の説明に供される部分断面図である。

【図３】（Ａ），（Ｂ）、（Ｃ）、（Ｄ）は、それぞれ、本発明に係る電極の回復処理方法の第１実施例の各工程におけるバンプの先端部が部分的に拡大して示され、各工程の説明に供される部分断面図である。

【図４】（Ａ），（Ｂ），（Ｃ）は、それぞれ、比較例の各工程におけるバンプの先端部が部分的に拡大して示され、比較例の各工程の説明に供される部分断面図である。

【図５】（Ａ），（Ｂ）、（Ｃ）は、それぞれ、バンプの先端が使用により摩耗していく各工程の説明に供される図である。

【図６】（Ａ），（Ｂ）、（Ｃ）は、それぞれ、バンプの先端が部分的に拡大されて示され、図５（Ａ），（Ｂ）、（Ｃ）に示されるバンプの先端が使用により摩耗していく各工程の説明に供される図である。

【図７】本発明に係る電極の回復処理方法の第１実施例および第２実施例が適用されるコンタクトシートを備える半導体装置用ソケットの一例を示す部分断面図である。

【図８】図７に示される例におけるキャリアユニットの構成を概略的に示す部分断面図である。

【図９】図８に示される例における平面図である。

【図１０】（Ａ），（Ｂ），（Ｃ）は、それぞれ、本発明に係る電極の回復処理方法の第２実施例の各工程の説明に供される要部を拡大して示す部分断面図である。

【図１１】（Ａ），（Ｂ），（Ｃ）は、それぞれ、図１０（Ａ），（Ｂ），（Ｃ）に示される図の一部を拡大して示す部分断面図である。

【図１２】（Ａ）は、本発明に係る電極の回復処理方法の第１実施例に用いられる他のキ

ャリアハウジングおよびベース部材の一例の構成を分解して示す構成図であり、（Ｂ）は、（Ａ）におけるキャリアハウジングを含むキャリアユニットの構成を示す構成図である。

【図１３】（Ａ）は、本発明に係る電極の回復処理方法の第１実施例に用いられるさらなる他のキャリアハウジングおよびベース部材の一例の構成を分解して示す構成図であり、（Ｂ）は、（Ａ）におけるキャリアハウジングを含むキャリアユニットの構成を示す構成図である。

【図１４】（Ａ）は、本発明に係る電極の回復処理方法の第１実施例に用いられるさらなる他のキャリアハウジングおよびベース部材の一例の構成を分解して示す構成図であり、（Ｂ）は、（Ａ）におけるキャリアハウジングを含むキャリアユニットの構成を示す構成図である。

【図１５】本発明に係る電極の回復処理方法の第３実施例に用いられるキャリアユニットステージの構成を転写板固定ヘッドとともに示す断面図である。

【図１６】図１５に示される例における平面図である。

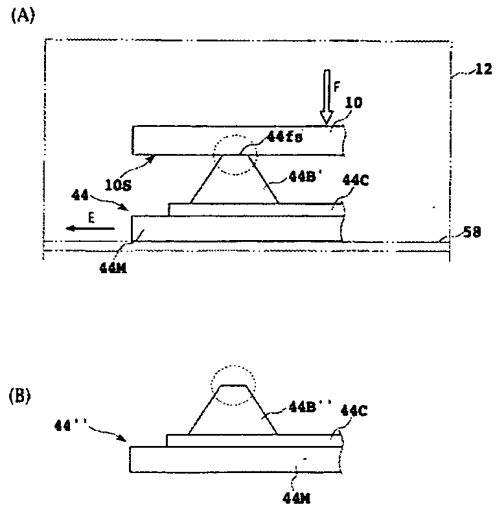
【図１７】図１５に示されるキャリアハウジングおよびキャリアユニットステージの構成を分解して示す構成図である。

【図１８】本発明に係る電極の回復処理方法の第３実施例に用いられる摺動装置の全体構成を示す構成図である。

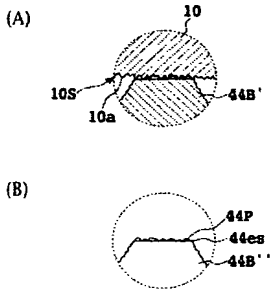
【符号の説明】

１０ａ　凹凸
１０、１０４　転写板
１０ｓ　転写面
１２　恒温槽
４４、８０　コンタクトシート
４４Ｂ、４４Ｂ’、４４Ｂ”、８４Ｂ，８４Ｂ’　バンプ
４４ａ、４４ｐｓ、４４ｍｓ、８４ａ　凹凸
４４Ｍ，８４Ｍ　基材
６０　ベアチップ
８６　結晶物
１２６　Ｘ軸方向ステージ部材
１３０　Ｙ軸方向ステージ部材
１３６　回転ステージ
１４０　Ｚ軸方向ステージ部材
１６０，１６２，１６４、１６６　駆動用モータ

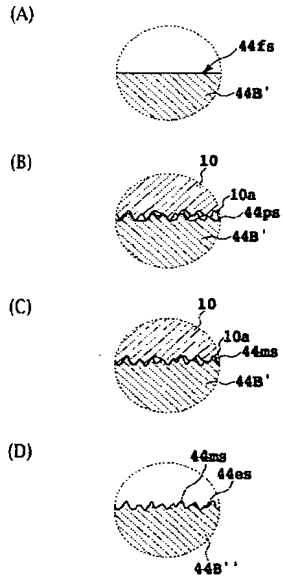
【図１】


(A)
12
F
10
44fs
10S
44B'
44C
44
E
58
44M
(B)
44B''
44C
44''
44M

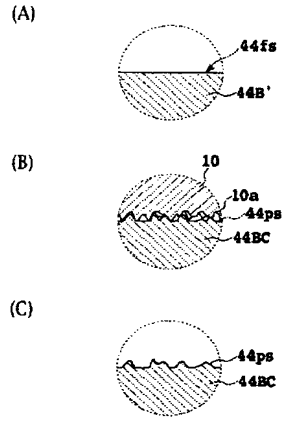
【図２】


(A)
10
10S
44B'
10a
(B)
44P
44es
44B''

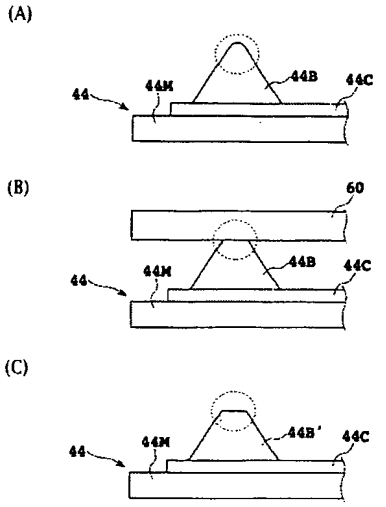
【図３】


(A)
44fs
44B'
(B)
10
10a
44ps
44B'
(C)
10
10a
44ms
44B'
(D)
44ms
44es
44B''

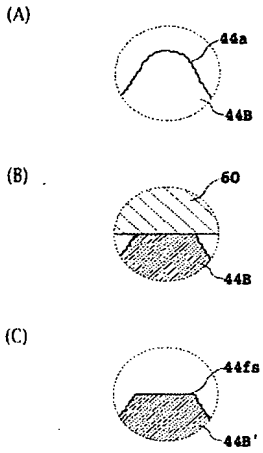
【図４】


(A)
44fs
44B'
(B)
10
10a
44ps
44BC
(C)
44ps
44BC

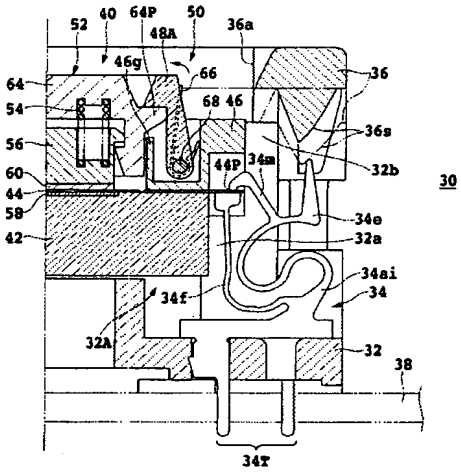
【図５】


(A)
44
44M
44B
44C
(B)
60
44
44M
44B
44C
(C)
44
44M
44B'
44C

【図６】


(A)
44a
44B
(B)
60
44B
(C)
44fs
44B'

【図７】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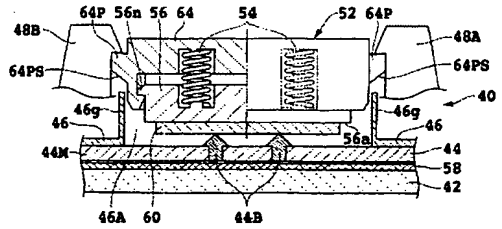
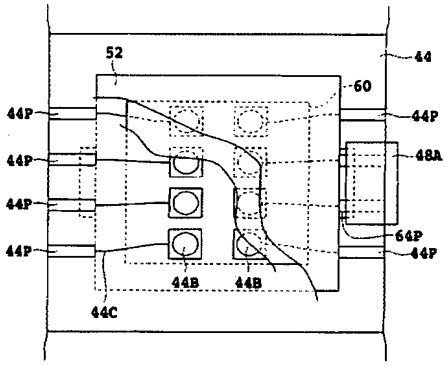
40
64P
48A
50
36a
46g
66
36
64
54
68
46
36s
56
44P
34m
32b
30
60
44
58
34e
42
32a
34ai
34
34f
32A
32
38
34T

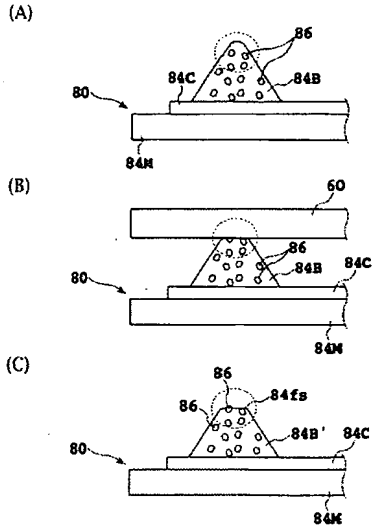
【図８】


64P
56n
56
64
54
52
64P
48B
48A
64PS
64PS
40
46g
46g
46
46
56a
44M
44
58
42
46A
60
44B

【図９】


52
44
60
44P
44P
44P
48A
44P
44P
64P
44P
44B
44B
44C

【図１０】



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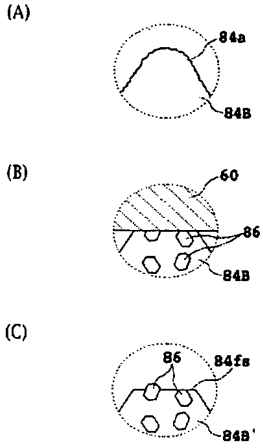

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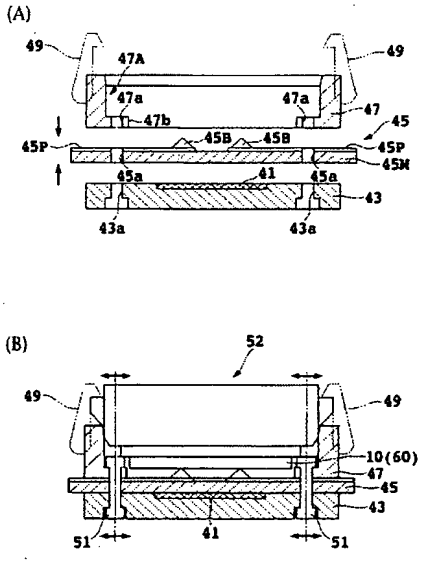

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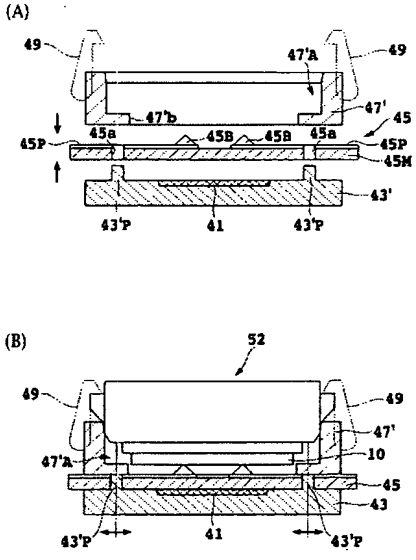

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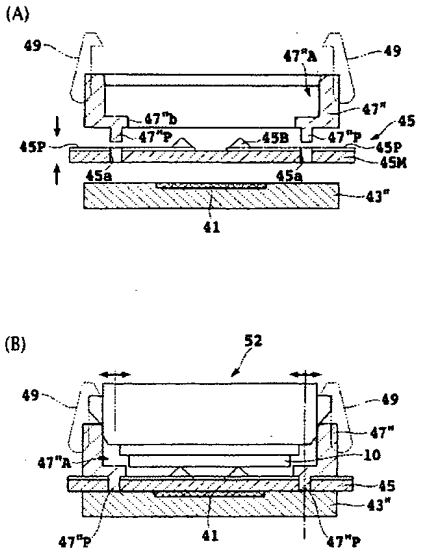

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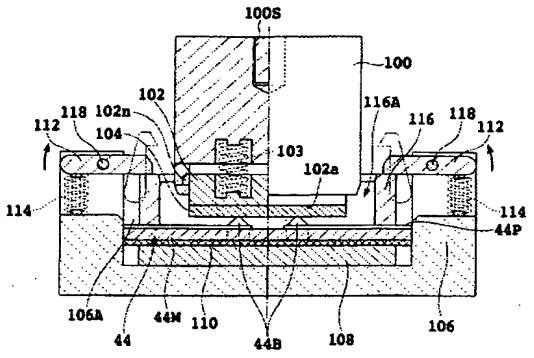

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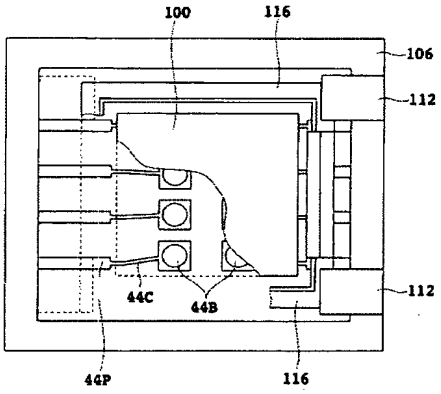

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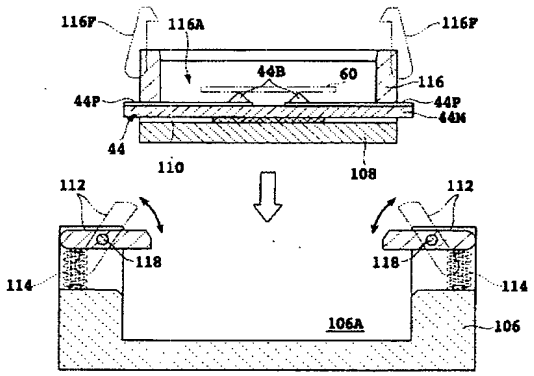

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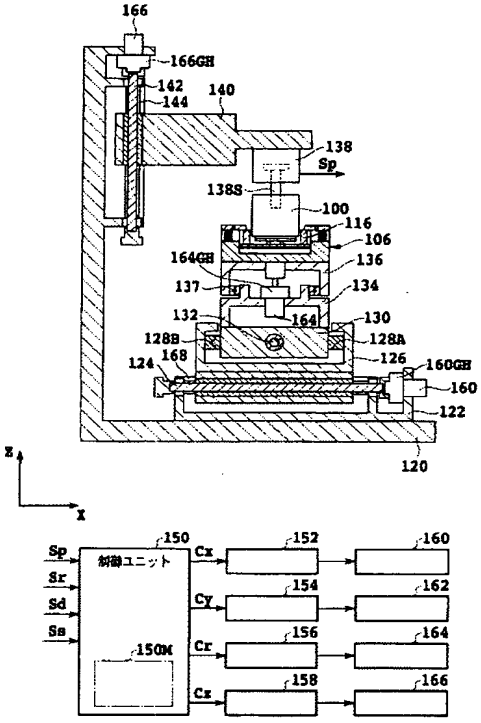
166
166GH
142
144
140
138
Sp
138S
100
116
106
164GH
136
137
134
132
164
130
128B
128A
124
168
126
160GH
160
122
120
Z
X
150
制御ユニット
Sp
Sr
Sd
Ss
150M
Cx
Cy
Cr
Cz
152
154
156
158
160
162
164
166

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2004-056078
(43)Date of publication of application : 19.02.2004

(51)Int.Cl. H01L 21/60
// G01R 1/073

(21)Application number : 2003-003508
(22)Date of filing : 09.01.2003

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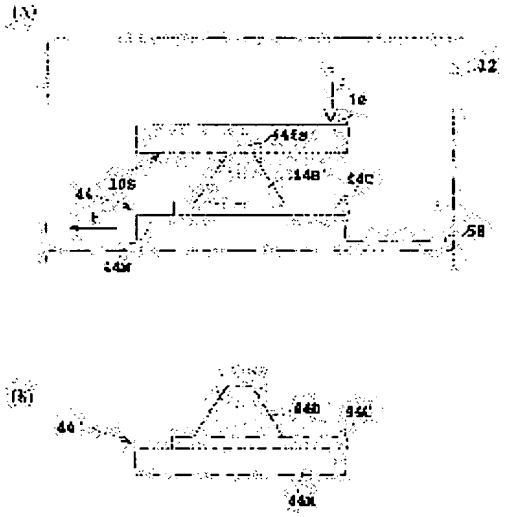
WAKABAYASHI YOSHINORI

(30)Priority
Priority number : 2002153062 Priority date : 27.05.2002 Priority country : JP

(54) RECOVERY METHOD FOR ELECTRODE

(57)Abstract:
PROBLEM TO BE SOLVED: To facilitate and ensure the formation of predetermined roughness on the connecting surface of an electrode of a worn electrode plate.
SOLUTION: A transfer surface 10a of a transfer plate 10 having a predetermined transfer surface 10s with prescribed roughness is brought into contact, at predetermined pressure, with a plurality of bumps 44B on a contact sheet 44 which is formed on a substrate 44M having a linear expansion coefficient larger than that of the transfer plate 10. Simultaneously, the substrate 44M and the transfer plate 10 are heated to a predetermined temperature to recover the roughness of the connecting surface of the bump 44B at a predetermined level.



LEGAL STATUS

[Date of request for examination]	28.08.2003
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3771907
[Date of registration]	17.02.2006
[Number of appeal against examiner's decision of rejection]	

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]
The 1st process which lays this front face and this connection side of an imprint plate which have the polar zone formed on an insulating substrate, and have the front face where it is made from the ingredient of the coefficient of linear expansion of the insulating substrate of this electrode plate, and a different coefficient of linear expansion by the connection side of this polar zone in the electrode plate which performs electrical installation through the connection side of this polar zone to the terminal area of a semiconductor device, and irregularity is formed in it so that it may contact mutually,
They are a predetermined period and the 2nd process to heat at predetermined temperature about this imprint plate and said electrode plate, turning to the connection side of this polar zone the imprint plate laid in the connection side of said polar zone in said 1st process, and pressing it by the predetermined pressure,
The 3rd process which is made to isolate said imprint plate to said electrode plate, and obtains predetermined irregularity to the connection side of said polar zone,
The recovery approach of the electrode which becomes by ******.
[Claim 2]
The predetermined temperature and the predetermined period in said 2nd process are the recovery approach of the electrode according to claim 1 which is a temperature requirement from 80 degrees C or more to less than 150 degrees C, and is characterized by being set as the period for 15 or less minutes 5 minutes or more, respectively.
[Claim 3]
The 1st process which lays the terminal area of this semiconductor device in the connection side of this polar zone in the electrode plate which the polar zone which comes by specified quantity **** into this base material is formed on an insulating substrate in the minute crystal object which has the abrasion resistance which was excellent as compared with the abrasion resistance of a base material, and performs electrical installation through the connection side of this polar zone to the terminal area of a semiconductor device,
The 2nd process which obtains predetermined irregularity to this connection side by wearing this connection side, contacting the terminal area of said semiconductor device to the connection side of said electrode plate, and exposing said some of crystal objects,
The recovery approach of the electrode which becomes by ******.
[Claim 4]
Said crystal object is the recovery approach of the electrode according to claim 3 characterized by having the becoming degree of hardness and being made from PARAJUUMU or nickel with comparatively high electrical conductivity size from the degree of hardness of the copper which is said base material.
[Claim 5]
The 1st process which lays this front face and this connection side of an imprint plate which have the polar zone formed on an insulating substrate, and have the front face where irregularity is formed in the connection side of this polar zone in the electrode plate which performs

electrical installation through the connection side of this polar zone to the terminal area of a semiconductor device so that it may contact mutually,
They are the specified quantity and the 2nd process to which it is made to move relatively once [at least] to the direction of the gap which is not abbreviation parallel to this connection side about the connection side of this imprint plate or this polar zone, turning to the connection side of this polar zone the imprint plate laid in the connection side of said polar zone in said 1st process, and pressing it by the predetermined pressure,
The 3rd process which is made to isolate said imprint plate to said electrode plate, and obtains predetermined irregularity to the connection side of said polar zone,
The recovery approach of the electrode which becomes by ******.
[Claim 6]
The recovery approach of the electrode according to claim 5 characterized by making this electrode plate move to said imprint plate with the sliding equipment moved to abbreviation parallel to the connection side of said polar zone in said 2nd process, supporting said electrode plate.
[Claim 7]
The recovery approach of an electrode according to claim 1 or 5 that thrust in said 2nd process is characterized by being 1g or more per polar zone 100g or less.
[Claim 8]
The recovery approach of an electrode according to claim 5 that the specified quantity of the relative migration in said 2nd process is characterized by 1-micrometer or more being 1mm or less.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone which performs electrical installation to the terminal of a semiconductor device can be recovered so that it may become predetermined surface roughness.
[0002]
[Description of the Prior Art]
In the IC socket for electronic equipment, or a connector, it is requested that the terminal of the semiconductor device with which the electrode of the substrate for wiring is equipped is generally connected certainly electrically. In such equipment, as shown also in JP,8-96865,A and JP,2000-294043,A, forming by etching processing is proposed [projection / thermal spraying or / minute] in ceramic-flame-spraying coats enough in order to break through the oxide skin formed in the terminal at the electric contact section of the conductor pattern to which the terminal (electrode) of a semiconductor device is connected electrically, or the end face of a track, for example. Thus, by forming a minute projection in the electric contact section or the end face of a track, since a mutual touch area is reduced and the contact pressure per unit area increases, the effectiveness that an oxide skin is easy to be destroyed will be done so.
[0003]
Consequently, the terminal of a semiconductor device will be electrically connected to the electrode of the substrate for wiring certainly.
[0004]
[Problem(s) to be Solved by the Invention]
In the above IC sockets for electronic equipment, when the electric contact section of a conductor pattern is used repeatedly, since there is a fixed life also in the endurance of the minute projection which has the above abrasion resistance, and a ceramic-flame-spraying coat, a minute projection will be worn out with contact pressure etc. therefore, abbreviation which does not have irregularity, without recovering the electric contact section or the end face of a track according to operating frequency -- since it becomes a flat front face, there is a possibility that a touch area may increase and contact pressure may become inadequate. Consequently, the positive electric connection obtained at the beginning may not no longer be obtained as it uses it.
[0005]
It is the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone to which this invention performs electrical installation to the terminal of a semiconductor device in consideration of the above trouble can be recovered so that it may become predetermined surface roughness, and aims at offering the recovery approach of the electrode which can form easy and, certainly predetermined irregularity to the connection side of the polar zone of the worn-out electrode plate.
[0006]

[Means for Solving the Problem]
In order to attain the above-mentioned purpose, the recovery approach of the electrode concerning this invention To the connection side of the polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which it is made from the ingredient of the coefficient of linear expansion of the insulating substrate of an electrode plate, and a different coefficient of linear expansion, and irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of said polar zone in the 1st process, and pressing it by the predetermined pressure A predetermined period, the 2nd process to heat, and an imprint plate are made to isolate an imprint plate and this electrode plate to said electrode plate at predetermined temperature, and it comes to contain the 3rd process which obtains predetermined irregularity to the connection side of the polar zone.
[0007]
Moreover, the 2nd predetermined temperature and predetermined period in a process are a temperature requirement from 80 degrees C or more to less than 150 degrees C, and may be set as the period for 15 or less minutes 5 minutes or more, respectively.
[0008]
Furthermore, the recovery approach of the electrode concerning this invention The polar zone which comes by specified quantity **** into a base material is formed on an insulating substrate in the minute crystal object which has the abrasion resistance which was excellent as compared with the abrasion resistance of a base material. The 1st process which lays the terminal area of a semiconductor device in the connection side of the polar zone in the electrode plate which performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device, It comes to contain the 2nd process which obtains predetermined irregularity to a connection side by wearing a connection side, contacting the terminal area of a semiconductor device to the connection side of an electrode plate, and exposing some crystal objects.
[0009]
A crystal object has the degree of hardness which consists of a degree of hardness of the copper which is a base material size, and may be made from PARAJUUMU or nickel with comparatively high electrical conductivity.
[0010]
The recovery approach of the electrode concerning this invention further again To the connection side of this polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the predetermined pressure To a connection side, it shifts and comes to include an imprint plate or the connection side of the polar zone the 3rd process without abbreviation parallel which obtains irregularity predetermined to the connection side of the polar zone once [at least] in that direction by making the specified quantity, the 2nd process to which it is made to move relatively, and an imprint plate isolate to an electrode plate.
[0011]
Moreover, an electrode plate is made to move to an imprint plate in the 2nd process with the sliding equipment moved to abbreviation parallel to the connection side of the polar zone, supporting an electrode plate.
[0012]
The thrust in the 2nd process may be 1g or more per polar zone 100g or less, and the specified quantity of the relative migration in the 2nd process may be 1 micrometers or more 1mm or less.

[0013]
[Embodiment of the Invention]
Drawing 7 shows the socket for semiconductor devices equipped with the electrode plate for connection with which the 1st example, 2nd example mentioned later, and 3rd example of the recovery approach of the electrode concerning this invention are applied.
[0014]
In the socket for semiconductor devices shown in drawing 7 , it considers as the electrical-characteristics trial of a semiconductor device, and the thing specifically used for a burn in test etc., for example. The socket for semiconductor devices is constituted including the carrier unit 40 by which the bare chip as a semiconductor device is held in the interior, and IC socket 30 with which the hold section is equipped with the carrier unit 40 removable.
[0015]
The body section 32 which has the hold section which IC socket 30 is arranged on the printed-circuit board 38 which outputs and inputs the inspection signal to a bare chip, the detection output signal from a bare chip, etc., and holds the carrier unit 40, The contact group 34 which consists of two or more contacts electrically connected to each pad of the contact sheet as an electrode plate for connection which is formed in the body section 32 and serves as a component in the carrier unit 40, and which is mentioned later, respectively, The covering member 36 which is allotted possible [a vertical movement] to the body section 32, and connects each contact surface of the contact group 34 to each pad of a contact sheet electrically alternatively is constituted as main elements.
[0016]
The body section 32 fabricated with a resin ingredient is arranged in the predetermined location corresponding to the polar zone of a printed-circuit board 38. The body section 32 has hold section 32A in which the carrier unit 40 is held, as shown in drawing 7 . Hold section 32A is surrounded by the inner circumference section of lower pedestal 32a which engages with the lower part of the base section of the carrier unit 40 mentioned later, and the inner circumference section of up pedestal 32b which stands in a row in lower pedestal 32a, and engages with the upper part of the base section, and is formed. The contact group 34 is supported by lower pedestal 32a. the contact group 34 is constituted in lower pedestal 32a and up pedestal 32b -- each -- the slit in which contact 34ai (i=1- n and n integer) is inserted is formed.
[0017]
each -- contact 34ai (i=1- n and n integer) 34f of fixed side contact surfaces which stand in a row in terminal area 34T currently pressed fit in lower pedestal 32a, and terminal area 34T, and are electrically connected to the pad of a contact sheet from a lower part side, 34m of movable side contact surfaces which have elasticity, stand in a row in terminal area 34T, and are electrically connected to the pad of a contact sheet from an upper part side, It engages with the slant surface part of the covering member 36 which branches from 34m of movable side contact surfaces, and is mentioned later alternatively, and is constituted including engaged portion 34e which rotates 34m of movable side contact surfaces in the direction isolated to 34f of fixed side contact surfaces.
[0018]
each -- contact 34ai is arranged at the predetermined spacing along the abbreviation perpendicular direction in drawing 7 to space corresponding to the pad of the contact sheet 44 mentioned later. In addition, in drawing 7 , the contact group 34 of only the part corresponding to one side in the contact group 34 which encloses the four way type of hold section 32A is shown.

[0019]
The covering member 36 fabricated with a resin ingredient has opening 36a which the carrier unit 40 passes. A part for the frame which forms the periphery of opening 36a is supported possible [a vertical movement] by the leg guided in the slot established in the periphery section of the body section 32. In addition, the covering member 36 is energized in the direction isolated to the body section 32 by the elastic member to which illustration is abbreviated. the time of the

covering member 36 being made to descend to the lower limit of each side for the frame to a predetermined location, as shown by the NI point chain line of drawing 7 -- a **** -- each -- it engages with engaged portion 34e of contact 34ai, and 36s of slant surface parts which rotate 34m of movable side contact surfaces in the direction which resists the elastic force and is isolated to 34f of fixed side contact surfaces is formed, respectively.

[0020]

When hold section 32A of the body section 32 of IC socket 30 is equipped with the carrier unit 40 mentioned later, after the covering member 36 is made to retreat to hold section 32A the specified quantity and by carrying out depression maintenance in 34m of each traveling contact section of the contact group 34, the carrier unit 40 is positioned and laid in hold section 32A through opening 36a from the upper part. 34f of fixed side contact surfaces is made to contact the inferior-surface-of-tongue side of the pad of the contact sheet 44 in the carrier unit 40 in that case.

[0021]

then, the time of the covering member 36 in the condition of having been held being released -- the return force of an above-mentioned elastic body -- and -- each -- the covering member 36 is made to go up by resultant force of the elastic force of engaged portion 34e of contact 34ai 34m of each traveling contact section of the contact group 34 is returned to the original location, and it is made to contact the top-face side of the pad of the contact sheet 44 of the carrier unit 40 in that case. By that cause, as shown in drawing 7 , the contact sheet 44 and the contact group 34 will be connected electrically.

[0022]

The carrier housing 46 which has hold section 46A in which a bare chip 60 is held as the carrier unit 40 is shown in drawing 8 , The contact sheet 44 arranged through the elastic sheet 58 on the base member 42 which forms the pars basilaris ossis occipitalis of hold section 46A of the carrier housing 46, It is constituted including the lid 52 for press which comes to contain the press object 56 which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and the ratchet mechanism 50 (refer to drawing 7) which holds the lid 52 for press alternatively in the carrier housing 46.

[0023]

As shown in drawing 8 , the lid 52 for press is arranged on the space between the press object 56 which has press side 56a which contacts the top face of a bare chip 60, the body 64 of a lid which holds the base of the press object 56, and the crevice of the base of the press object 56 and the comparatively deep crevice of the body 64 of a lid, and is constituted including two or more springs 54 which turn the press object 56 to a bare chip 60, and energize it.

[0024]

The bare chip 60 of an abbreviation square has the predetermined electrode group on the inferior surface of tongue which counters the bump of the contact sheet 44.

[0025]

The base of the press object 56 is inserted movable into the comparatively shallow large crevice of the body 64 of a lid. 56n of claw parts which engage with the claw part prepared in the lower limit of the body 64 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 56 is inserted. [two or more] By this, the press object 56 will be held in the condition of having been energized by the energization force of a spring 54 at the body 64 of a lid.

[0026]

The body 64 of a lid has height 64p to which the hook members 48A and 48B of a ratchet mechanism 50 engage with the both ends which counter, respectively. At the time of wearing of the lid 52 for press, height 64p engages with the inclined plane at the tip of the hook members 48A and 48B, and has slant surface part 64ps which presses the hook members 48A and 48B in the direction isolated mutually so that it may mention later.

[0027]

The hook members 48A and 48B which a ratchet mechanism 50 is supported by the both ends of the carrier housing 46 rotatable, respectively, and hold the body 64 of a lid, The torsion coiled

spring 66 energized in the direction where an arrow head shows the hook members 48A and 48B in drawing 7 , respectively, i.e., the direction made to engage with height 64p of the body 64 of a lid, It is constituted including the hook members 48A and 48B and the support shaft 68 which supports the torsion coiled spring 66.

[0028]

When equipped with the lid 52 for press, 46g of guide sections to which it shows the periphery section of the lower part of the body 64 of a lid is formed in the both ends of the carrier housing 46. The both ends of the support shaft 68 are supported around 46g of guide sections.

[0029]

The contact sheet 44 has two or more bump 44B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 44M, as shown in drawing 8 and drawing 9 . For example, only height predetermined [front face / of the copper used as a base material / the front face of base material 44M to] in nickel and the tip of each bump 44B which gold plate processing is carried out and is formed is projected. Base material 44M are made for example, from a polyimide resin ingredient (coefficient of linear expansion: 35x10-6/degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0030]

Each bump 44B is connected to pad 44p through conductor-layer 44c made from copper foil, as shown in drawing 9 . Pad 44p is formed in the both ends which project towards the exterior from the both ends of the base member 42 in base material 44M, respectively.

[0031]

In addition, only the predetermined range is supported relatively [front face / of the base member 42] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.

[0032]

In this configuration, in equipping with a bare chip 60 in the carrier unit 40, first, the electrode group of a bare chip 60 is positioned to bump 44B of the contact sheet 44, and it is arranged so that the electrode group of a bare chip 60 may contact bump 44B. Next, the lid 52 for press is inserted into hold section 46A of the carrier housing 46. It rotates in the direction which resists the energization force of the torsion coiled spring 66, and the tip of the hook members 48A and 48B of a ratchet mechanism 50 isolates mutually by slant surface part 64ps of the body 64 of a lid of the lid 52 for press in that case. Moreover, the peripheral face of the body 64 of a lid being guided at the inside which is 46g of guide sections, press side 56a of the press object 56 resists the energization force of a spring 54, and is forced on the top face of a bare chip 60.

[0033]

Then, by being energized from the torsion coiled spring 66, the tip of the hook members 48A and 48B rotates in the direction which approaches mutually, and engages with height 64p of the body 64 of a lid. Consequently, the lid 52 for press will be held at the carrier housing 46.

[0034]

And as the carrier unit 40 mentioned above, where hold section 32A is equipped, a trial will be performed in a predetermined ambient atmosphere to a bare chip 60.

[0035]

Repeat use of the above contact sheets 44 will be carried out in such a trial to the new bare chip 60 with which it is equipped with a predetermined number.

[0036]

Before presenting such a trial, each bump 44B has the approximate circle drill-like configuration so that it may be expanded to drawing 5 (A) and may be shown at the beginning. Moreover, as the latest section of bump 44B is expanded and it is shown in it at drawing 6 (A), minute concavo-convex 44a is formed in the whole front face.

[0037]

Next, the latest section of bump 44B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 5 (B) and drawing 6 (B) and may be shown, when a trial is presented with the contact sheet 44.

[0038]
Then, by carrying out repeat use of the contact sheet 44 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 44B' is crushed, and serves as the approximate circle frustum configuration of having a flat side so that it may be expanded to drawing 5 (C) and drawing 6 (C) and may be shown. Flatness side 44fs with such each smooth bump 44B' does not have minute irregularity as shown in drawing 6 (A).
[0039]
Therefore, when used more than the count of predetermined, without being exchanged in the contact sheet 44 of one sheet, there is a possibility that the electrical installation the contact sheet 44 and between bare chip 60 may become uncertain.
[0040]
Then, in the 1st example of the recovery approach of the electrode concerning this invention, the imprint plate 10 which has predetermined thickness as shown in drawing 1 (A) beforehand is prepared. The imprint plate 10 is made from the tool steel between the colds (JIS notation SKS, SKD) (coefficient of linear expansion: about 11.5x10- 6/degree C) which carried out plating processing as surface treatment with chromium (coefficient of linear expansion: about 6.2x10- 6/degree C), and at least, as it is expanded to drawing 2 (A) and shown in 10s of imprint sides of one side, it has concavo-convex 10a of predetermined granularity.
[0041]
First, as shown in drawing 1 (A), while the contact sheet 44 with which the bump was worn out is arranged, the above-mentioned carrier unit 40 equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [predetermined room air temperature]. It shall have a thermostat 12 in the heat regulator which can adjust indoor temperature to adjustable.
[0042]
The imprint plate 10 is laid on the common flat surface formed of two or more flatness side 44fs (es) so that 10s of the imprint side may contact flatness side 44fs in which each bump 44B' in a thermostat 12 was worn out in that case. Therefore, the imprint plate 10 will be supported by flatness side 44fs of two or more bump 44B'. It is pressurized by the energization force of a spring 54 by the predetermined pressure along the direction which the arrow head F shown in drawing 1 (A) shows through the press object 56 in that case. The welding pressure is set as the range of one bump 44B per 1g or more abbreviation [100g or less]. When it is less than 1g of bump 44B per abbreviation whose welding pressure is one piece according to verification by the artificer of this application, per [whose welding pressure there is almost no effectiveness of recovery and is one piece / bump 44B], when exceeding 100g, and the protrusion height of bump 44B becomes lower than criteria too much and crushing of the tip of bump 44B serves as size comparatively Since it was checked that the problem of exerting comparatively big damage on the electrode of an inspected object arises, the welding pressure is set as the range of one bump 44B per 1g or more abbreviation [100g or less].
[0043]
Drawing 3 (B) expands the condition of the point of bump 44B' immediately after 10s of imprint sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44B' will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 3 (B).
[0044]
Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [from 80 degrees C or more] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.
[0045]
Therefore, the imprint plate 10 and the contact sheet 44 [when it expands in the direction which the arrow head E of drawing 1 (A) shows along with the temperature rise of a room temperature, respectively] Since the coefficient of thermal expansion of base material 44M is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the

contact sheet 44 will resist mutual frictional force concavo-convex 44ps and 10s of imprint sides shown in drawing 3 (B), and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the field in which concavo-convex 44ps is formed will be further deleted by relative sliding of about dozens of micrometers to minute irregularity of contact sheet 44 and 10s of imprint sides of bump 44B' 10a, and 44ms of irregularity of granularity with the finer surface roughness as shown in drawing 3 (C) will be formed.
[0046]
Then, as contact sheet 44" which has bump 44B" by which recovery was carried out is shown in drawing 1 (B), it is taken out from the carrier unit 40.
[0047]
Therefore, 44ms of comparatively detailed irregularity corresponding to the press and sliding of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest field 44es of bump 44B", without applying comparatively big thrust so that it may be expanded to drawing 2 (B) and drawing 3 (D) and may be shown.
[0048]
Moreover, as mentioned above, by heating, since it becomes easy to transform bump 44B, formation of above-mentioned irregularity becomes easier.
[0049]
Drawing 4 (A), (B), and (C) show the condition of each process of bump 44B' in the example of a comparison verified by the artificer of the invention in this application, respectively.
[0050]
In the example of a comparison, it considers only as what the contact sheet 44 with which bump 44B' as expanded to drawing 4 (A) like an above-mentioned example and shown in the above-mentioned carrier unit 40 was worn out is arranged, and is equipped with the imprint plate 10 same instead of being a bare chip 60 as mentioned above, without being heated like an above-mentioned example in performing recovery of an electrode.
[0051]
In this example of a comparison, bump 44B' is pressurized with the imprint plate 10 by the same predetermined pressure as an above-mentioned example along the direction which the arrow head F shown in drawing 1 (A) shows according to the energization force of a spring 54 through the press object 56. Drawing 4 (B) expands the condition of the point of bump 44BC immediately after 10s of imprint sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44BC will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 4 (B).
[0052]
Next, the contact sheet which has bump 44BC by which recovery was carried out is taken out from the carrier unit 40.
[0053]
Therefore, comparatively coarse concavo-convex 44ps corresponding to the press of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest field of bump 44BC so that it may be expanded to drawing 4 (C) and may be shown.
[0054]
Consequently, in the approach of the example of a comparison, it was checked that 44ms of comparatively detailed irregularity which is obtained in the example 1 of this application is not formed.
[0055]
In addition, in the invention in this application, effectiveness which applied the file to the connection side of bump 44B will be acquired by relative sliding between 10s of imprint sides and bump 44B which were mentioned above, moreover, as compared with the case where it imprints only by press, spacing of the irregularity will be more narrow, and irregularity will be formed certainly.
[0056]
Drawing 10 (A), (B), and (C) show typically each process in the 2nd example of the recovery

approach of the electrode concerning this invention.
[0057]
Drawing 10 (A) The contact sheet 80 used for the example shown in - (C) has two or more bump 84B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 84M, as shown in drawing 10 (A). The tip of each of that bump 84B has projected only predetermined height from the front face of base material 84M. Minute concavo-convex 84a is formed in the whole front face at the tip so that it may be expanded to drawing 11 (A) and may be shown.
[0058]
Each bump 84B is electrically connected to the pad (un-illustrating) through conductor-layer 84C made from copper foil. The pad is formed in the both ends which project towards the exterior from the both ends of the above base members 42 in base material 84M, respectively. Each bump 84B is formed in the gold (Knoop hardness: 80-200) or copper (Knoop hardness: 250-320) used as a base material in the shape of an approximate circle drill with the ingredient with which the predetermined crystal object 86 was mixed by abbreviation homogeneity.
[0059]
When a base material is gold, the crystal object 86 has the degree of hardness which consists of a golden degree of hardness size, is made from PARAJUUMU (Pd) with a particle diameter [with comparatively high electrical conductivity] of about 2-3 micrometers, and (Knoop hardness:250-350), and is mixed with the content of about 15 - 20% / vol extent.
[0060]
Moreover, when a base material is copper, the crystal object 86 has the degree of hardness which consists of a copper degree of hardness size, is made from nickel (nickel) with a particle diameter [with comparatively high electrical conductivity] of about 2-3 micrometers, and (Knoop hardness:300-490), and is mixed with the content of about 15 - 20% / vol extent.
[0061]
Base material 84M are made for example, from a polyimide resin ingredient (coefficient of linear expansion: 35x10-6/degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.
[0062]
In carrying out recovery of the bump 84B as an electrode of this contact sheet 80, it is the basis arranged as mentioned above in the carrier unit 40 with the above-mentioned contact sheet 80 of one sheet, and recovery of the connection side at the tip of bump 84B will be automatically carried out by carrying out repeat use to a bare chip 60. Therefore, the press process and heating process of the imprint plate 10 used in the 1st above-mentioned example are made unnecessary.
[0063]
That is, the latest section of bump 84B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 10 (B) and drawing 11 (B) and may be shown, when a trial is presented with the contact sheet 80 in the carrier unit 40.
[0064]
then, by carrying out repeat use of the contact sheet 80 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 84B' crushes so that it may be expanded to drawing 10 (C) and drawing 11 (C) and may be shown -- having -- abbreviation -- it becomes the approximate circle frustum configuration of having a flat field. As shown in drawing 11 (C), minute irregularity will be formed in apical surface 84fs of such each bump 84B' when some of two or more crystal objects 86 contained by wear of a base material are exposed.
[0065]
Therefore, a field with new minute irregularity will be automatically formed in the latest section of each bump 84B' with wear of the base material of the latest section of each bump 84B'.
[0066]
In the carrier unit 40 used for the 1st example of the recovery approach of the electrode concerning above-mentioned this invention, only the predetermined range is supported relatively

[front face / of the base member 42] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.
[0067]
However, the carrier unit which the structure of the carrier unit 40 does not necessarily need to be made in this way, for example, is shown in drawing 12 (A), (B) - drawing 14 (A), and (B) may be used.
[0068]
In drawing 12 (A) a carrier unit The carrier housing 47 which has hold section 47A in which a bare chip 60 or the imprint plate 10 is held like an above-mentioned example, The base member 43 which forms the pars basilaris ossis occipitalis of hold section 47A of the carrier housing 47, The contact sheet 45 arranged through the elastic sheet 41 on the base member 43, It is constituted including the lid 52 for press which comes to contain the press object which presses the electrode group or the imprint plate 10 of a bare chip 60 to bump 45B of the contact sheet 45, and the ratchet mechanism 49 which holds the lid 52 for press alternatively in the carrier housing 47. In addition, since the structures of the lid 52 for press and a ratchet mechanism 49 are a lid for press in the 1st above-mentioned example, and the structure and identitas of a ratchet mechanism, they omit the duplication explanation.
[0069]
The carrier housing 47 is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion: 56x10-6/degree C) is desirable, for example. As shown in drawing 12 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47A of the carrier housing 47 is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. Hole 47a by which the conclusion member 51 later mentioned around central opening 47b is inserted in the bottom surface part of hold section 47A of the carrier housing 47 is formed in four places.
[0070]
The contact sheet 45 has two or more bump 45B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 45M. For example, only height predetermined [front face / of the copper used as a base material / the front face of base material 45M to] in nickel and the tip of each bump 45B which gold plate processing is carried out and is formed is projected. Base material 45M are made for example, from a polyimide resin ingredient (coefficient of linear expansion: 35x10-6/degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.
[0071]
Each bump 44B is connected to pad 45p through the conductor layer made from copper foil. Two or more pad 45p is formed in the both ends which project towards the exterior from the both ends of the base member 43 in base material 45M, respectively.
[0072]
The contact sheet 45 has hole 45a in which the conclusion member 51 is inserted corresponding to hole 47a of the carrier housing 47 around two or more bump 44B.
[0073]
The base member 43 is fabricated with the same ingredient as the ingredient of the carrier housing 47, and has hole 43a corresponding to hole 47a of the carrier housing 47, and hole 45a of the contact sheet 45.
[0074]
One of the roles which the elastic sheet 41 arranged just under two or more bump 44B of the contact sheet 45 plays is making into homogeneity dispersion in the contact force of bump 45B which originates in the protrusion height of each bump 45B like an above-mentioned example.
[0075]
As shown in drawing 12 (B), as a conclusion member 51 which concludes the carrier housing 47 and the base member 43 of each other on both sides of the contact sheet 45, a rivet or a screw, and a nut are desirable, for example.

[0076]
When such a carrier unit is used, while the contact sheet 45 with which the bump was worn out is first arranged like the 1st above-mentioned example in a bump's recovery, the above-mentioned carrier unit equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [predetermined room air temperature].
[0077]
The conditions of thrust are set up like the 1st above-mentioned example.
[0078]
Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [from 80 degrees C or more] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.
[0079]
Therefore, the imprint plate 10, and the base member 43, the carrier housing 47 and the contact sheet 45 [when it expands along with the temperature rise of a room temperature, respectively] Since the coefficient of linear expansion of carrier housing 47 grade is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.
[0080]
Drawing 13 (A) and (B) show other carrier units used for an example of the recovery approach of the electrode concerning this invention, respectively.
[0081]
In the carrier unit shown in drawing 12 (A) and (B), although the carrier housing 47 and the base member 43 of each other are concluded by the conclusion member 51 on both sides of the contact sheet 45 instead, in drawing 13 (A) and (B), the carrier housing 47 and the base member 43 of each other are joined on both sides of the contact sheet 45 by adhesives or fusion welding. In addition, in drawing 13 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.
[0082]
Carrier housing 47' is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion: 56x10-6/degree C) is desirable, for example. As shown in drawing 13 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47'A of carrier housing 47' is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part which forms the base of hold section 47'A of carrier housing 47', opening 47'b is formed in the center.
[0083]
Base member 43' is fabricated with the same ingredient as the ingredient of carrier housing 47', and has gage pin 43'P in four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 43'P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the field where the elastic sheet 41 is arranged. Let locator-pin 43'P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of base member 43', or the variation rate of contraction while it positions the relative position to base member 43' of the contact sheet 45. the base -- a member -- 43 -- ' -- a carrier -- housing -- 47 -- ' -- hold -- the section -- 47 -- ' -- A -- receiving -- a relative position -- fusion welding -- the time -- positioning -- having .
[0084]
Also in this example the imprint plate 10, and base member 43', and carrier housing 47' and the contact sheet 45 [when it expands along with the temperature rise of a room temperature, respectively] Since coefficient of linear expansion, such as carrier housing 47', is set as size

rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0085]

drawing 14 (A) and (B) are used for an example of the recovery approach of the electrode concerning this invention, respectively -- being the further -- others -- a carrier unit is shown.

[0086]

the carrier unit shown in drawing 13 (A) and (B) -- setting -- the contact sheet 45 -- inserting -- carrier housing 47' and a locator pin 43, although the 'base member 43 which has P' of each other is joined instead -- drawing 14 -- (-- A --) -- and -- (-- B --) -- setting -- adhesives -- or -- fusion welding -- contact -- a sheet -- 45 -- inserting -- a locator pin -- 47 -- " -- P -- having -- a carrier -- housing -- 47 -- " -- the base -- a member -- 43 -- " -- mutual -- joining -- having -- a thing -- ** -- carrying out -- having . In addition, in drawing 14 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.

[0087]

Carrier housing 47" is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion: 56x10-6/degree C) is desirable, for example. As shown in drawing 14 (B), when being equipped with the lid 52 for press, the inner circumference section of carrier housing 47 "hold section 47" A is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part of carrier housing 47 "hold section 47" A, opening 47"b is formed in the center. In the surrounding external surface of opening 47"b, gage pin 47"P has projected at four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 47"P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the base. Let locator-pin 47"P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of carrier housing 47", or the variation rate of contraction while it positions the relative position to carrier housing 47" of the contact sheet 45. The relative position to base member 43" of hold section 47'A of carrier housing 47" is positioned at the time of fusion welding.

[0088]

Base member 43" is fabricated with the same ingredient as the ingredient of carrier housing 47."

[0089]

Also in this example the imprint plate 10, and base member 43", and carrier housing 47" and the contact sheet 45 [when it expands along with the temperature rise of a room temperature, respectively] Since coefficient of linear expansion, such as carrier housing 47", is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0090]

Drawing 15 and drawing 16 show roughly the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention, respectively with the imprint plate fixed head.

[0091]

In addition, in drawing 15 and drawing 16 , the same sign is attached and shown about the component made the same in the carrier unit in the example shown in drawing 7 and drawing 8 , and the duplication explanation is omitted. Moreover, in drawing 15 and drawing 16 , the condition

that some components of the carrier unit in the condition that the lid for press was removed were held in the carrier unit stage is shown.

[0092]

As the part is shown in drawing 15 and drawing 17 , a carrier unit The carrier housing 116 which has hold section 116A in which a bare chip 60 is held, The contact sheet 44 arranged through the elastic sheet 110 on the base member 108 which forms the pars basilaris ossis occipitalis of hold section 116A of the carrier housing 116, It is constituted including ratchet-mechanism 116F which hold alternatively the lid for press which comes to contain the press object which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and (un-illustrating) and its lid for press in the carrier housing 116.

[0093]

In addition, the above-mentioned lid for press which is not illustrated is equipped with the configuration in the example shown in drawing 8 , and the same configuration.

[0094]

Ratchet-mechanism 116F are constituted by the both ends of the carrier housing 116 as shown in drawing 7 including the hook member which is supported rotatable with a support shaft and holds the edge of the lid for press, and the coil spring which energizes a hook member in the direction made to engage with the edge of the lid for press, respectively, respectively.

[0095]

The carrier unit stage 106 has hold section 106A which holds the carrier housing 116 temporarily in the recovery of bump 44B of the contact sheet 44. As shown in drawing 15 and drawing 17 , in order to regulate the relative position to hold section 106A of the base member 108, the inner circumference section of hold section 106A which carries out opening towards the upper part is formed so that it may engage with the edge of the base member 108.

[0096]

As shown in drawing 16 and drawing 17 , the ratchet mechanism of the pair held removable in hold section 106A carries out phase opposite of the carrier housing 116 of a carrier unit, and it is prepared in the periphery section of hold section 106A. The ratchet mechanism is constituted by the wall which forms hold section 106A in the carrier unit stage 106 including the hook member 112 which is supported rotatable with the support shaft 118 and holds the periphery section of hold section 116A of the carrier housing 116, and the coil spring 114 which energizes the hook member 112 in the direction made to engage with the periphery section of hold section 116A, respectively, respectively.

[0097]

As shown to drawing 17 by the two-dot chain line, the end resists the energization force of a coil spring 114, and when equipped only with the carrier housing 116 of a carrier unit in hold section 106A, or when being removed from hold section 106A, the hook member 112 is rotated so that it may be isolated out of hold section 106A. On the other hand, when the carrier housing 116 is held in hold section 106A, the end of the hook member 112 is contacted by the periphery section of hold section 116A of the carrier housing 116 according to the energization force of a coil spring 114, as shown in drawing 15 and drawing 17 .

[0098]

When recovery is performed about the contact sheet 44 with which the bump was worn out so that it may mention later, the imprint plate fixed head is arranged in hold section 116A of the carrier housing 116 in a carrier unit, as shown in drawing 15 .

[0099]

The press object 102 which has fixed side 102a to which the imprint plate 104 is fixed as the imprint plate fixed head is shown in drawing 15 , The body 100 of a lid which has the crevice in which the base of the press object 102 is held, It is allotted to each space between the crevice of the base of the press object 102, and the comparatively deep crevice of the body 100 of a lid, respectively, and is constituted including two or more springs 103 which turn the imprint plate 104 to bump 44B of the contact sheet 44, and energize it.

[0100]

The base of the press object 102 is inserted movable into the comparatively shallow large

crevice of the body 100 of a lid. 102n of claw parts which engage with the claw part prepared in the lower limit of the body 100 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 102 is inserted. [two or more] By this, the press object 102 will be held at the body 100 of a lid in the condition of having been energized by the energization force of two or more springs 103.
[0101]
One field of the imprint plate 104 made from a metallic material or a ceramic ingredient is being fixed by adhesion or the conclusion implement to fixed side 102a. Irregularity with predetermined flatness and predetermined surface roughness is formed in the field of another side of the imprint plate 104. In addition, the imprint plate 104 may be formed in the press object 102 and one, without being restricted to this example. Moreover, the press object 102 may be formed in the body 100 of a lid, and one, for example, without two or more springs 103 intervening.
[0102]
On the other hand, the lid for press of a carrier unit (un-illustrating) is held by the ratchet-mechanism 116F at the carrier housing 116, when a trial is performed to a bare chip 60.
[0103]
100s of female screw sections in which the male screw section of the load cell mentioned later is inserted is prepared in the abbreviation center section of the upper part of the body 100 of a lid.
[0104]
Drawing 18 shows roughly the whole sliding equipment configuration to which the contact sheet 44 is relatively moved to the imprint plate fixed head in the process of the recovery about bump 44B of the contact sheet 44.
[0105]
sliding equipment be constitute including the table device section which make it move in the predetermined direction , and the pressurization device section which the imprint plate fixed head be hold [section] and make a predetermined pressure act on bump 44B of the imprint plate 104 and the contact sheet 44 while fix the carrier unit stage 106 holding the carrier housing 116 with which it be allot on the base member 120 , and the contact sheet 44 be hold .
[0106]
The pedestal 122 matched with the table device section on the base member 120, and X shaft-orientations stage member 126 moved by the ball screw member 124 supported by the pedestal 122, Y shaft-orientations stage member 130 moved in the direction of an axis of the ball screw member 124 by the ball screw member 132 supported by X shaft-orientations stage member 126 along the direction which carries out an abbreviation rectangular cross, It is constituted including the rotation stage 136 which is supported rotatable by the stage supporter 134 allotted to Y shaft-orientations stage member 130, and holds a carrier unit.
[0107]
A pedestal 122 consists of a handstand surface part which carries out breadth extension in the direction which an arrow head Z shows to an abbreviation perpendicular to the flat part formed along the direction which the arrow head X in drawing 18 shows, and a flat part.
[0108]
X shaft-orientations stage member 126 is guided with a guide rail 168, and is supported by the ball screw member 124 movable through the nut. The both ends of the ball screw member 124 are supported by the edge which met in the direction which an arrow head X shows in drawing 18 in the flat part of a pedestal 122, respectively. The output shaft of the drive motor 160 fixed to a pedestal 122 through moderation device 160GH, such as an epicyclic gear device, is connected with one edge of the ball screw member 124. In addition, as for a drive motor 160, a linear motor, a stepping motor, a servo motor, etc. may be used. A drive motor 160 and each drive motor mentioned later are controlled by the control unit 150 mentioned later.
[0109]
Y shaft-orientations stage member 130 is supported by the inner circumference section of X shaft-orientations stage member 126 movable along the perpendicular direction at space with the guide rails 128A and 128B by which pair opposite arrangement is carried out. Moreover, Y

shaft-orientations stage member 130 is supported by the ball screw member 132 movable through the nut. The both ends of the ball screw member 132 are supported by the edge which met perpendicularly in drawing 18 in X shaft-orientations stage member 126 at space, respectively. The output shaft of the drive motor 162 fixed to X shaft-orientations stage member 126 through moderation devices, such as an epicyclic gear device, is connected with one edge of the ball screw member 132. As for a drive motor 162, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0110]

The drive motor 164 is being fixed to the center section of the stage supporter 134 fixed to the top face of Y shaft-orientations stage member 130. The stage supporter 134 is being fixed to the top face of Y shaft-orientations stage member 130 through the notch of X shaft-orientations stage member 126. It connects with the output shaft of a drive motor 164 inside the center of the disk section of the rotation stage 136 through moderation device 164GH. The side attachment wall of the rotation stage 136 is supported by the upper part of the stage supporter 134 rotatable through bearing 137. As for a drive motor 164, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0111]

This will rotate the rotation stage 136 to the circumference of the medial-axis line of Y shaft-orientations stage member 130, and the medial-axis line of the stage supporter 134, when a drive motor 164 is made into an operating state.

[0112]

The carrier unit stage 106 is being fixed by the conclusion member to which illustration is abbreviated, for example, a **** member etc., to the disk section of the rotation stage 136.

[0113]

The pressurization device section is constituted including Z shaft-orientations stage member 140 which transmits thrust to the imprint plate fixed head, the ball screw member 142 which it is inserted in Z shaft-orientations stage member 140, and is supported movable, and the drive motor 166 made to rotate the ball screw member 142 while holding the load cell 138 which detects the thrust to bump 44B through the imprint plate fixed head, and a load cell 138.

[0114]

The both ends of the ball screw member 142 are supported by the bracket section of the pair prepared in a handstand surface part by having predetermined spacing rotatable, respectively. One edge of the ball screw member 142 is connected with the output shaft of the drive motor 166 fixed to a handstand surface part through moderation device 166GH. As for a drive motor 166, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0115]

Z shaft-orientations stage member 140 is guided with the guide rail 144 so that it may be inserted in so that the ball screw member 142 may serve as an abbreviation perpendicular to the axis through a nut, and it may not rotate.

[0116]

The load cell 138 is connected with the body 100 of a lid by thrusting into 100s of female screw sections of the imprint plate fixed head 138s of male screw sections connected with the internal sensor section. A load cell 138 sends out the detecting signal Sp which detects the thrust to the imprint plate fixed head of Z shaft-orientations stage member 140, and expresses thrust to a control unit 150.

[0117]

The migration direction command signal Sd showing the direction where the reset command signal Sr and the carrier housing 116 showing the instruction which returns the location of each stage member from the host computer for production control with which illustration is omitted to a predetermined criteria location should move to a control unit 150, the recovery initiation command signal Ss, and the detecting signal Sp from the above-mentioned load cell 138 are supplied.

[0118]

Moreover, the control unit 150 equips the interior with the memory section 150 in which the

program data for performing the data showing the set point of the thrust to the imprint plate fixed head set up according to the contact sheet 44 or the set point of the movement magnitude of the carrier housing 116 (carrier unit stage 106) and recovery etc. are stored.
[0119]
The value of the thrust is set up according to the magnitude of bump 44B, for example, let it be the range of 1g or more per electrode 100g or less. As an example of the range of the minimum in the value of thrust, it considers as the range of 1g or more per electrode 40g or less.
[0120]
The movement magnitude of the one direction of the carrier housing 116 (carrier unit stage 106) is set up so that bending of the play of each device and the contact sheet 44 etc. may be considered, and it may be set up, for example, the relative movement magnitude of bump 44B may serve as the 1-micrometer or more range of 1mm or less. As an example of the range of the minimum in the relative movement magnitude of bump 44B, it considers as the 1-micrometer or more range of 100 micrometers or less.
[0121]
In the recovery by the 3rd example in the recovery approach of the electrode concerning this invention, first, as shown in drawing 18 , the carrier unit stage 106 in which the carrier housing 116 with which the contact sheet 44 with which the bump was worn out is arranged was attached is held at the disk section of the rotation stage 136 in a predetermined criteria location.

[0122]
Next, a control unit 150 sets up the movement magnitude of each stage member so that the movement magnitude of the carrier housing 116 and the carrier unit stage 106 may serve as a predetermined value based on the data in the recovery initiation command signal Ss, the migration direction command signal Sd, and the memory section 150.
[0123]
A control unit 150 sets up the movement magnitude of the Z-axis stage 140 based on the data of the set point of the thrust in a detecting signal Sp and 150m of memory sections in that case.

[0124]
A control unit 150 forms the pulse control signal Cz according to the set-up movement magnitude, and supplies it to the motorised circuit 158. Based on the pulse control signal Cz, a driving signal shall be supplied to the motorised circuit 158.
[0125]
Then, a control unit 150 forms the pulse control signals Cx, Cy, and Cr so that it may move the carrier housing 116 and the carrier unit stage 106 only once [at least] according to the set-up movement magnitude, and it supplies them to the motorised circuits 152, 154, and 156, respectively. Based on the pulse control signals Cx, Cy, and Cr, a driving signal shall be supplied to the motorised circuits 152, 154, and 156 to drive motors 160, 162, and 164, respectively.
[0126]
Thereby, only the specified quantity is made to move relatively bump 44B of the contact sheet 44 in the carrier housing 116 in the predetermined direction once to the imprint plate 104.
[0127]
Therefore, the comparatively detailed irregularity corresponding to the press and sliding of an imprint side of minute irregularity in the imprint plate 104 will be formed in the edge at which the bump was worn out, without applying comparatively big thrust like the case of the 1st above-mentioned example. The irregularity is spacing of for example, about 0.1-micrometer or more 50-micrometer or less extent, and is formed in about 0.001-micrometer or more height of 5 micrometers or less. As range of the minimum of the irregularity, it is spacing of about 0.1-micrometer or more 50-micrometer or less extent, and considers as the range of about 0.002-micrometer or more height 3 micrometers or less, for example.
[0128]
Moreover, in this example, since it is not necessary to heat like [in the case of the 1st example], control of the amount of sliding in recovery is easy, and it can process comparatively

for a short period of time, consequently is more suitable for mass-production nature.
[0129]
And that thrust should be canceled, a control unit 150 forms the pulse control signal Cz, and supplies it to the motorised circuit 158.
[0130]
The carrier housing 116 with which the contact sheet by which recovery was carried out is held is removed from the carrier unit stage 106. In that case, a control unit 150 forms the control pulse signals Cx, Cy, Cr, and Cz, and supplies them to the motorised circuits 152, 154, 156, and 158 so that it may return the location of each stage member to a predetermined criteria location based on the control signal Sr supplied.
[0131]
After being equipped with a bare chip 60 and the lid for press, the hold section of IC socket 30 will be equipped with the removed carrier housing 116 as a carrier unit like an above-mentioned example.
[0132]
[Effect of the Invention]
According to the recovery approach of the electrode concerning this invention, so that clearly from the above explanation Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the predetermined pressure Easy and, certainly predetermined irregularity can be formed in the connection side of the polar zone of the electrode plate worn out since the imprint plate and the electrode plate were deleted from the connection side of an electrode by predetermined granularity at predetermined temperature a predetermined period and by sliding relatively according to the expansion difference since it heats.
[Brief Description of the Drawings]
[Drawing 1] (A) and (B) are drawings showing typically each process of the 1st example of the recovery approach of the electrode concerning this invention, respectively.
[Drawing 2] (A) is a fragmentary sectional view with which is a fragmentary sectional view with which explanation of each process is presented, and a bump's point in the process shown in drawing 1 (B) expands (B) partially, is shown [a bump's point in the process shown in drawing 1 (A) is expanded partially, and is shown, and], and explanation of each process is presented.
[Drawing 3] (A), (B), (C), and (D) are fragmentary sectional views with which a bump's point in each process of the 1st example of the recovery approach of the electrode concerning this invention is expanded partially, and is shown, respectively, and explanation of each process is presented.
[Drawing 4] (A), (B), and (C) are fragmentary sectional views with which a bump's point in each process of the example of a comparison is expanded partially, and is shown, and explanation of each process of the example of a comparison is presented, respectively.
[Drawing 5] (A), (B), and (C) are drawings with which explanation of each process at which a bump's tip is worn out by use is presented, respectively.
[Drawing 6] A bump's tip which a bump's tip is expanded partially, respectively, and (A), (B), and (C) are shown, and is shown in drawing 5 (A), (B), and (C) is drawing with which explanation of each process worn out by use is presented.
[Drawing 7] It is the fragmentary sectional view showing an example of the socket for semiconductor devices equipped with the contact sheet with which the 1st example and the 2nd example of the recovery approach of the electrode concerning this invention are applied.
[Drawing 8] It is the fragmentary sectional view showing roughly the configuration of the carrier unit in the example shown in drawing 7 .
[Drawing 9] It is a top view in the example shown in drawing 8 .
[Drawing 10] (A), (B), and (C) are the fragmentary sectional views expanding and showing the important section with which explanation of each process of the 2nd example of the recovery approach of the electrode concerning this invention is presented, respectively.
[Drawing 11] (A), (B), and (C) are the fragmentary sectional views expanding and showing some drawings shown in drawing 10 (A), (B), and (C), respectively.

[Drawing 12] (A) is the block diagram decomposing and showing the configuration of an example of other carrier housing used for the 1st example of the recovery approach of the electrode concerning this invention, and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).
[Drawing 13] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention -- being the further -- others -- it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).
[Drawing 14] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention -- being the further -- others -- it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).
[Drawing 15] It is the sectional view showing the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention with the imprint plate fixed head.
[Drawing 16] It is a top view in the example shown in drawing 15 .
[Drawing 17] It is the block diagram decomposing and showing the configuration of carrier housing shown in drawing 15 , and a carrier unit stage.
[Drawing 18] It is the block diagram showing the whole sliding equipment configuration used for the 3rd example of the recovery approach of the electrode concerning this invention.
[Description of Notations]
10a Irregularity
10,104 Imprint plate
10s Imprint side
12 Thermostat
44 80 Contact sheet
44B, 44B', 44B″, and 84B and 84B -- ' -- Bump
44a, 44ps, 44ms, 84a Irregularity
44M, 84M Base material
60 Bare Chip
86 Crystal Object
126 X Shaft-Orientations Stage Member
130 Y Shaft-Orientations Stage Member
136 Rotation Stage
140 Z Shaft-Orientations Stage Member
160,162,164 166 Motor for a drive

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention]
This invention relates to the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone which performs electrical installation to the terminal of a semiconductor device can be recovered so that it may become predetermined surface roughness.
[0002]

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PRIOR ART

[Description of the Prior Art]
In the IC socket for electronic equipment, or a connector, it is requested that the terminal of the semiconductor device with which the electrode of the substrate for wiring is equipped is generally connected certainly electrically. In such equipment, as shown also in JP,8-96865,A and JP,2000-294043,A, forming by etching processing is proposed [projection / thermal spraying or / minute] in ceramic-flame-spraying coats enough in order to break through the oxide skin formed in the terminal at the electric contact section of the conductor pattern to which the terminal (electrode) of a semiconductor device is connected electrically, or the end face of a track, for example. Thus, by forming a minute projection in the electric contact section or the end face of a track, since a mutual touch area is reduced and the contact pressure per unit area increases, the effectiveness that an oxide skin is easy to be destroyed will be done so.
[0003]
Consequently, the terminal of a semiconductor device will be electrically connected to the electrode of the substrate for wiring certainly.
[0004]

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EFFECT OF THE INVENTION

[Effect of the Invention]
According to the recovery approach of the electrode concerning this invention, so that clearly from the above explanation Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the predetermined pressure Easy and, certainly predetermined irregularity can be formed in the connection side of the polar zone of the electrode plate worn out since the imprint plate and the electrode plate were deleted from the connection side of an electrode by predetermined granularity at predetermined temperature a predetermined period and by sliding relatively according to the expansion difference since it heats.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
In the above IC sockets for electronic equipment, when the electric contact section of a conductor pattern is used repeatedly, since there is a fixed life also in the endurance of the minute projection which has the above abrasion resistance, and a ceramic-flame-spraying coat, a minute projection will be worn out with contact pressure etc. therefore, abbreviation which does not have irregularity, without recovering the electric contact section or the end face of a track according to operating frequency -- since it becomes a flat front face, there is a possibility that a touch area may increase and contact pressure may become inadequate. Consequently, the positive electric connection obtained at the beginning may not no longer be obtained as it uses it.
[0005]
It is the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone to which this invention performs electrical installation to the terminal of a semiconductor device in consideration of the above trouble can be recovered so that it may become predetermined surface roughness, and aims at offering the recovery approach of the electrode which can form easy and, certainly predetermined irregularity to the connection side of the polar zone of the worn-out electrode plate.
[0006]

[Translation done.]

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MEANS

[Means for Solving the Problem]
In order to attain the above-mentioned purpose, the recovery approach of the electrode concerning this invention To the connection side of the polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which it is made from the ingredient of the coefficient of linear expansion of the insulating substrate of an electrode plate, and a different coefficient of linear expansion, and irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of said polar zone in the 1st process, and pressing it by the predetermined pressure A predetermined period, the 2nd process to heat, and an imprint plate are made to isolate an imprint plate and this electrode plate to said electrode plate at predetermined temperature, and it comes to contain the 3rd process which obtains predetermined irregularity to the connection side of the polar zone.
[0007]
Moreover, the 2nd predetermined temperature and predetermined period in a process are a temperature requirement from 80 degrees C or more to less than 150 degrees C, and may be set as the period for 15 or less minutes 5 minutes or more, respectively.
[0008]
Furthermore, the recovery approach of the electrode concerning this invention The polar zone which comes by specified quantity **** into a base material is formed on an insulating substrate in the minute crystal object which has the abrasion resistance which was excellent as compared with the abrasion resistance of a base material. The 1st process which lays the terminal area of a semiconductor device in the connection side of the polar zone in the electrode plate which performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device, It comes to contain the 2nd process which obtains predetermined irregularity to a connection side by wearing a connection side, contacting the terminal area of a semiconductor device to the connection side of an electrode plate, and exposing some crystal objects.
[0009]
A crystal object has the degree of hardness which consists of a degree of hardness of the copper which is a base material size, and may be made from PARAJUUMU or nickel with comparatively high electrical conductivity.
[0010]
The recovery approach of the electrode concerning this invention further again To the connection side of this polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the

predetermined pressure To a connection side, it shifts and comes to include an imprint plate or the connection side of the polar zone the 3rd process without abbreviation parallel which obtains irregularity predetermined to the connection side of the polar zone once [at least] in that direction by making the specified quantity, the 2nd process to which it is made to move relatively, and an imprint plate isolate to an electrode plate.
[0011]
Moreover, an electrode plate is made to move to an imprint plate in the 2nd process with the sliding equipment moved to abbreviation parallel to the connection side of the polar zone, supporting an electrode plate.
[0012]
The thrust in the 2nd process may be 1g or more per polar zone 100g or less, and the specified quantity of the relative migration in the 2nd process may be 1 micrometers or more 1mm or less.

[0013]
[Embodiment of the Invention]
Drawing 7 shows the socket for semiconductor devices equipped with the electrode plate for connection with which the 1st example, 2nd example mentioned later, and 3rd example of the recovery approach of the electrode concerning this invention are applied.
[0014]
In the socket for semiconductor devices shown in drawing 7 , it considers as the electrical-characteristics trial of a semiconductor device, and the thing specifically used for a burn in test etc., for example. The socket for semiconductor devices is constituted including the carrier unit 40 by which the bare chip as a semiconductor device is held in the interior, and IC socket 30 with which the hold section is equipped with the carrier unit 40 removable.
[0015]
The body section 32 which has the hold section which IC socket 30 is arranged on the printed-circuit board 38 which outputs and inputs the inspection signal to a bare chip, the detection output signal from a bare chip, etc., and holds the carrier unit 40, The contact group 34 which consists of two or more contacts electrically connected to each pad of the contact sheet as an electrode plate for connection which is formed in the body section 32 and serves as a component in the carrier unit 40, and which is mentioned later, respectively, The covering member 36 which is allotted possible [a vertical movement] to the body section 32, and connects each contact surface of the contact group 34 to each pad of a contact sheet electrically alternatively is constituted as main elements.
[0016]
The body section 32 fabricated with a resin ingredient is arranged in the predetermined location corresponding to the polar zone of a printed-circuit board 38. The body section 32 has hold section 32A in which the carrier unit 40 is held, as shown in drawing 7 . Hold section 32A is surrounded by the inner circumference section of lower pedestal 32a which engages with the lower part of the base section of the carrier unit 40 mentioned later, and the inner circumference section of up pedestal 32b which stands in a row in lower pedestal 32a, and engages with the upper part of the base section, and is formed. The contact group 34 is supported by lower pedestal 32a. the contact group 34 is constituted in lower pedestal 32a and up pedestal 32b -- each -- the slit in which contact 34ai (i=1- n and n integer) is inserted is formed.
[0017]
each -- contact 34ai (i=1- n and n integer) 34f of fixed side contact surfaces which stand in a row in terminal area 34T currently pressed fit in lower pedestal 32a, and terminal area 34T, and are electrically connected to the pad of a contact sheet from a lower part side, 34m of movable side contact surfaces which have elasticity, stand in a row in terminal area 34T, and are electrically connected to the pad of a contact sheet from an upper part side, It engages with the slant surface part of the covering member 36 which branches from 34m of movable side contact surfaces, and is mentioned later alternatively, and is constituted including engaged portion 34e which rotates 34m of movable side contact surfaces in the direction isolated to 34f of fixed side

contact surfaces.
[0018]
each -- contact 34ai is arranged at the predetermined spacing along the abbreviation perpendicular direction in drawing 7 to space corresponding to the pad of the contact sheet 44 mentioned later. In addition, in drawing 7 , the contact group 34 of only the part corresponding to one side in the contact group 34 which encloses the four way type of hold section 32A is shown.

[0019]
The covering member 36 fabricated with a resin ingredient has opening 36a which the carrier unit 40 passes. A part for the frame which forms the periphery of opening 36a is supported possible [a vertical movement] by the leg guided in the slot established in the periphery section of the body section 32. In addition, the covering member 36 is energized in the direction isolated to the body section 32 by the elastic member to which illustration is abbreviated. the time of the covering member 36 being made to descend to the lower limit of each side for the frame to a predetermined location, as shown by the NI point chain line of drawing 7 -- a **** -- each -- it engages with engaged portion 34e of contact 34ai, and 36s of slant surface parts which rotate 34m of movable side contact surfaces in the direction which resists the elastic force and is isolated to 34f of fixed side contact surfaces is formed, respectively.
[0020]
When hold section 32A of the body section 32 of IC socket 30 is equipped with the carrier unit 40 mentioned later, after the covering member 36 is made to retreat to hold section 32A the specified quantity and by carrying out depression maintenance in 34m of each traveling contact section of the contact group 34, the carrier unit 40 is positioned and laid in hold section 32A through opening 36a from the upper part. 34f of fixed side contact surfaces is made to contact the inferior-surface-of-tongue side of the pad of the contact sheet 44 in the carrier unit 40 in that case.
[0021]
then, the time of the covering member 36 in the condition of having been held being released -- the return force of an above-mentioned elastic body -- and -- each -- the covering member 36 is made to go up by resultant force of the elastic force of engaged portion 34e of contact 34ai 34m of each traveling contact section of the contact group 34 is returned to the original location, and it is made to contact the top-face side of the pad of the contact sheet 44 of the carrier unit 40 in that case. By that cause, as shown in drawing 7 , the contact sheet 44 and the contact group 34 will be connected electrically.
[0022]
The carrier housing 46 which has hold section 46A in which a bare chip 60 is held as the carrier unit 40 is shown in drawing 8 , The contact sheet 44 arranged through the elastic sheet 58 on the base member 42 which forms the pars basilaris ossis occipitalis of hold section 46A of the carrier housing 46, It is constituted including the lid 52 for press which comes to contain the press object 56 which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and the ratchet mechanism 50 (refer to drawing 7) which holds the lid 52 for press alternatively in the carrier housing 46.
[0023]
As shown in drawing 8 , the lid 52 for press is arranged on the space between the press object 56 which has press side 56a which contacts the top face of a bare chip 60, the body 64 of a lid which holds the base of the press object 56, and the crevice of the base of the press object 56 and the comparatively deep crevice of the body 64 of a lid, and is constituted including two or more springs 54 which turn the press object 56 to a bare chip 60, and energize it.
[0024]
The bare chip 60 of an abbreviation square has the predetermined electrode group on the inferior surface of tongue which counters the bump of the contact sheet 44.
[0025]
The base of the press object 56 is inserted movable into the comparatively shallow large crevice of the body 64 of a lid. 56n of claw parts which engage with the claw part prepared in the lower

limit of the body 64 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 56 is inserted. [two or more] By this, the press object 56 will be held in the condition of having been energized by the energization force of a spring 54 at the body 64 of a lid.

[0026]

The body 64 of a lid has height 64p to which the hook members 48A and 48B of a ratchet mechanism 50 engage with the both ends which counter, respectively. At the time of wearing of the lid 52 for press, height 64p engages with the inclined plane at the tip of the hook members 48A and 48B, and has slant surface part 64ps which presses the hook members 48A and 48B in the direction isolated mutually so that it may mention later.

[0027]

The hook members 48A and 48B which a ratchet mechanism 50 is supported by the both ends of the carrier housing 46 rotatable, respectively, and hold the body 64 of a lid, The torsion coiled spring 66 energized in the direction where an arrow head shows the hook members 48A and 48B in drawing 7 , respectively, i.e., the direction made to engage with height 64p of the body 64 of a lid, It is constituted including the hook members 48A and 48B and the support shaft 68 which supports the torsion coiled spring 66.

[0028]

When equipped with the lid 52 for press, 46g of guide sections to which it shows the periphery section of the lower part of the body 64 of a lid is formed in the both ends of the carrier housing 46. The both ends of the support shaft 68 are supported around 46g of guide sections.

[0029]

The contact sheet 44 has two or more bump 44B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 44M, as shown in drawing 8 and drawing 9 . For example, only height predetermined [front face / of the copper used as a base material / the front face of base material 44M to] in nickel and the tip of each bump 44B which gold plate processing is carried out and is formed is projected. Base material 44M are made for example, from a polyimide resin ingredient (coefficient of linear expansion: 35x10-6/degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0030]

Each bump 44B is connected to pad 44p through conductor-layer 44c made from copper foil, as shown in drawing 9 . Pad 44p is formed in the both ends which project towards the exterior from the both ends of the base member 42 in base material 44M, respectively.

[0031]

In addition, only the predetermined range is supported relatively [front face / of the base member 42] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.

[0032]

In this configuration, in equipping with a bare chip 60 in the carrier unit 40, first, the electrode group of a bare chip 60 is positioned to bump 44B of the contact sheet 44, and it is arranged so that the electrode group of a bare chip 60 may contact bump 44B. Next, the lid 52 for press is inserted into hold section 46A of the carrier housing 46. It rotates in the direction which resists the energization force of the torsion coiled spring 66, and the tip of the hook members 48A and 48B of a ratchet mechanism 50 isolates mutually by slant surface part 64ps of the body 64 of a lid of the lid 52 for press in that case. Moreover, the peripheral face of the body 64 of a lid being guided at the inside which is 46g of guide sections, press side 56a of the press object 56 resists the energization force of a spring 54, and is forced on the top face of a bare chip 60.

[0033]

Then, by being energized from the torsion coiled spring 66, the tip of the hook members 48A and 48B rotates in the direction which approaches mutually, and engages with height 64p of the body 64 of a lid. Consequently, the lid 52 for press will be held at the carrier housing 46.

[0034]

And as the carrier unit 40 mentioned above, where hold section 32A is equipped, a trial will be performed in a predetermined ambient atmosphere to a bare chip 60.

[0035]
Repeat use of the above contact sheets 44 will be carried out in such a trial to the new bare chip 60 with which it is equipped with a predetermined number.
[0036]
Before presenting such a trial, each bump 44B has the approximate circle drill-like configuration so that it may be expanded to drawing 5 (A) and may be shown at the beginning. Moreover, as the latest section of bump 44B is expanded and it is shown in it at drawing 6 (A), minute concavo-convex 44a is formed in the whole front face.
[0037]
Next, the latest section of bump 44B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 5 (B) and drawing 6 (B) and may be shown, when a trial is presented with the contact sheet 44.
[0038]
Then, by carrying out repeat use of the contact sheet 44 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 44B' is crushed, and serves as the approximate circle frustum configuration of having a flat side so that it may be expanded to drawing 5 (C) and drawing 6 (C) and may be shown. Flatness side 44fs with such each smooth bump 44B' does not have minute irregularity as shown in drawing 6 (A).
[0039]
Therefore, when used more than the count of predetermined, without being exchanged in the contact sheet 44 of one sheet, there is a possibility that the electrical installation the contact sheet 44 and between bare chip 60 may become uncertain.
[0040]
Then, in the 1st example of the recovery approach of the electrode concerning this invention, the imprint plate 10 which has predetermined thickness as shown in drawing 1 (A) beforehand is prepared. The imprint plate 10 is made from the tool steel between the colds (JIS notation SKS, SKD) (coefficient of linear expansion: about 11.5x10- 6/degree C) which carried out plating processing as surface treatment with chromium (coefficient of linear expansion: about 6.2x10- 6/degree C), and at least, as it is expanded to drawing 2 (A) and shown in 10s of imprint sides of one side, it has concavo-convex 10a of predetermined granularity.
[0041]
First, as shown in drawing 1 (A), while the contact sheet 44 with which the bump was worn out is arranged, the above-mentioned carrier unit 40 equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [predetermined room air temperature]. It shall have a thermostat 12 in the heat regulator which can adjust indoor temperature to adjustable.
[0042]
The imprint plate 10 is laid on the common flat surface formed of two or more flatness side 44fs (es) so that 10s of the imprint side may contact flatness side 44fs in which each bump 44B' in a thermostat 12 was worn out in that case. Therefore, the imprint plate 10 will be supported by flatness side 44fs of two or more bump 44B'. It is pressurized by the energization force of a spring 54 by the predetermined pressure along the direction which the arrow head F shown in drawing 1 (A) shows through the press object 56 in that case. The welding pressure is set as the range of one bump 44B per 1g or more abbreviation [100g or less]. When it is less than 1g of bump 44B per abbreviation whose welding pressure is one piece according to verification by the artificer of this application, per [whose welding pressure there is almost no effectiveness of recovery and is one piece / bump 44B], when exceeding 100g, and the protrusion height of bump 44B becomes lower than criteria too much and crushing of the tip of bump 44B serves as size comparatively Since it was checked that the problem of exerting comparatively big damage on the electrode of an inspected object arises, the welding pressure is set as the range of one bump 44B per 1g or more abbreviation [100g or less].
[0043]
Drawing 3 (B) expands the condition of the point of bump 44B' immediately after 10s of imprint

sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44B' will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 3 (B).
[0044]
Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [from 80 degrees C or more] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.
[0045]
Therefore, the imprint plate 10 and the contact sheet 44 [when it expands in the direction which the arrow head E of drawing 1 (A) shows along with the temperature rise of a room temperature, respectively] Since the coefficient of thermal expansion of base material 44M is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 44 will resist mutual frictional force concavo-convex 44ps and 10s of imprint sides shown in drawing 3 (B), and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the field in which concavo-convex 44ps is formed will be further deleted by relative sliding of about dozens of micrometers to minute irregularity of contact sheet 44 and 10s of imprint sides of bump 44B' 10a, and 44ms of irregularity of granularity with the finer surface roughness as shown in drawing 3 (C) will be formed.
[0046]
Then, as contact sheet 44″ which has bump 44B″ by which recovery was carried out is shown in drawing 1 (B), it is taken out from the carrier unit 40.
[0047]
Therefore, 44ms of comparatively detailed irregularity corresponding to the press and sliding of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest field 44es of bump 44B″, without applying comparatively big thrust so that it may be expanded to drawing 2 (B) and drawing 3 (D) and may be shown.
[0048]
Moreover, as mentioned above, by heating, since it becomes easy to transform bump 44B, formation of above-mentioned irregularity becomes easier.
[0049]
Drawing 4 (A), (B), and (C) show the condition of each process of bump 44B' in the example of a comparison verified by the artificer of the invention in this application, respectively.
[0050]
In the example of a comparison, it considers only as what the contact sheet 44 with which bump 44B' as expanded to drawing 4 (A) like an above-mentioned example and shown in the above-mentioned carrier unit 40 was worn out is arranged, and is equipped with the imprint plate 10 same instead of being a bare chip 60 as mentioned above, without being heated like an above-mentioned example in performing recovery of an electrode.
[0051]
In this example of a comparison, bump 44B' is pressurized with the imprint plate 10 by the same predetermined pressure as an above-mentioned example along the direction which the arrow head F shown in drawing 1 (A) shows according to the energization force of a spring 54 through the press object 56. Drawing 4 (B) expands the condition of the point of bump 44BC immediately after 10s of imprint sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44BC will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 4 (B).
[0052]
Next, the contact sheet which has bump 44BC by which recovery was carried out is taken out from the carrier unit 40.
[0053]
Therefore, comparatively coarse concavo-convex 44ps corresponding to the press of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest

field of bump 44BC so that it may be expanded to drawing 4 (C) and may be shown.
[0054]
Consequently, in the approach of the example of a comparison, it was checked that 44ms of comparatively detailed irregularity which is obtained in the example 1 of this application is not formed.
[0055]
In addition, in the invention in this application, effectiveness which applied the file to the connection side of bump 44B will be acquired by relative sliding between 10s of imprint sides and bump 44B which were mentioned above, moreover, as compared with the case where it imprints only by press, spacing of the irregularity will be more narrow, and irregularity will be formed certainly.
[0056]
Drawing 10 (A), (B), and (C) show typically each process in the 2nd example of the recovery approach of the electrode concerning this invention.
[0057]
Drawing 10 (A) The contact sheet 80 used for the example shown in - (C) has two or more bump 84B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 84M, as shown in drawing 10 (A). The tip of each of that bump 84B has projected only predetermined height from the front face of base material 84M. Minute concavo-convex 84a is formed in the whole front face at the tip so that it may be expanded to drawing 11 (A) and may be shown.
[0058]
Each bump 84B is electrically connected to the pad (un-illustrating) through conductor-layer 84C made from copper foil. The pad is formed in the both ends which project towards the exterior from the both ends of the above base members 42 in base material 84M, respectively. Each bump 84B is formed in the gold (Knoop hardness: 80-200) or copper (Knoop hardness: 250-320) used as a base material in the shape of an approximate circle drill with the ingredient with which the predetermined crystal object 86 was mixed by abbreviation homogeneity.
[0059]
When a base material is gold, the crystal object 86 has the degree of hardness which consists of a golden degree of hardness size, is made from PARAJUUMU (Pd) with a particle diameter [with comparatively high electrical conductivity] of about 2-3 micrometers, and (Knoop hardness:250-350), and is mixed with the content of about 15 - 20% / vol extent.
[0060]
Moreover, when a base material is copper, the crystal object 86 has the degree of hardness which consists of a copper degree of hardness size, is made from nickel (nickel) with a particle diameter [with comparatively high electrical conductivity] of about 2-3 micrometers, and (Knoop hardness:300-490), and is mixed with the content of about 15 - 20% / vol extent.
[0061]
Base material 84M are made for example, from a polyimide resin ingredient (coefficient of linear expansion: 35x10-6/degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.
[0062]
In carrying out recovery of the bump 84B as an electrode of this contact sheet 80, it is the basis arranged as mentioned above in the carrier unit 40 with the above-mentioned contact sheet 80 of one sheet, and recovery of the connection side at the tip of bump 84B will be automatically carried out by carrying out repeat use to a bare chip 60. Therefore, the press process and heating process of the imprint plate 10 used in the 1st above-mentioned example are made unnecessary.
[0063]
That is, the latest section of bump 84B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 10 (B) and drawing 11 (B) and may be shown, when a trial is presented with the contact sheet 80 in the carrier unit 40.

[0064]
then, by carrying out repeat use of the contact sheet 80 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 84B' crushes so that it may be expanded to drawing 10 (C) and drawing 11 (C) and may be shown -- having -- abbreviation -- it becomes the approximate circle frustum configuration of having a flat field. As shown in drawing 11 (C), minute irregularity will be formed in apical surface 84fs of such each bump 84B' when some of two or more crystal objects 86 contained by wear of a base material are exposed.
[0065]
Therefore, a field with new minute irregularity will be automatically formed in the latest section of each bump 84B' with wear of the base material of the latest section of each bump 84B'.
[0066]
In the carrier unit 40 used for the 1st example of the recovery approach of the electrode concerning above-mentioned this invention, only the predetermined range is supported relatively [front face / of the base member 42] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.
[0067]
However, the carrier unit which the structure of the carrier unit 40 does not necessarily need to be made in this way, for example, is shown in drawing 12 (A), (B) - drawing 14 (A), and (B) may be used.
[0068]
In drawing 12 (A) a carrier unit The carrier housing 47 which has hold section 47A in which a bare chip 60 or the imprint plate 10 is held like an above-mentioned example, The base member 43 which forms the pars basilaris ossis occipitalis of hold section 47A of the carrier housing 47, The contact sheet 45 arranged through the elastic sheet 41 on the base member 43, It is constituted including the lid 52 for press which comes to contain the press object which presses the electrode group or the imprint plate 10 of a bare chip 60 to bump 45B of the contact sheet 45, and the ratchet mechanism 49 which holds the lid 52 for press alternatively in the carrier housing 47. In addition, since the structures of the lid 52 for press and a ratchet mechanism 49 are a lid for press in the 1st above-mentioned example, and the structure and identitas of a ratchet mechanism, they omit the duplication explanation.
[0069]
The carrier housing 47 is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion: 56x10-6/degree C) is desirable, for example. As shown in drawing 12 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47A of the carrier housing 47 is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. Hole 47a by which the conclusion member 51 later mentioned around central opening 47b is inserted in the bottom surface part of hold section 47A of the carrier housing 47 is formed in four places.
[0070]
The contact sheet 45 has two or more bump 45B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 45M. For example, only height predetermined [front face / of the copper used as a base material / the front face of base material 45M to] in nickel and the tip of each bump 45B which gold plate processing is carried out and is formed is projected. Base material 45M are made for example, from a polyimide resin ingredient (coefficient of linear expansion: 35x10-6/degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.
[0071]
Each bump 44B is connected to pad 45p through the conductor layer made from copper foil. Two or more pad 45p is formed in the both ends which project towards the exterior from the both ends of the base member 43 in base material 45M, respectively.
[0072]
The contact sheet 45 has hole 45a in which the conclusion member 51 is inserted corresponding

to hole 47a of the carrier housing 47 around two or more bump 44B.
[0073]
The base member 43 is fabricated with the same ingredient as the ingredient of the carrier housing 47, and has hole 43a corresponding to hole 47a of the carrier housing 47, and hole 45a of the contact sheet 45.
[0074]
One of the roles which the elastic sheet 41 arranged just under two or more bump 44B of the contact sheet 45 plays is making into homogeneity dispersion in the contact force of bump 45B which originates in the protrusion height of each bump 45B like an above-mentioned example.
[0075]
As shown in drawing 12 (B), as a conclusion member 51 which concludes the carrier housing 47 and the base member 43 of each other on both sides of the contact sheet 45, a rivet or a screw, and a nut are desirable, for example.
[0076]
When such a carrier unit is used, while the contact sheet 45 with which the bump was worn out is first arranged like the 1st above-mentioned example in a bump's recovery, the above-mentioned carrier unit equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [predetermined room air temperature].
[0077]
The conditions of thrust are set up like the 1st above-mentioned example.
[0078]
Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [from 80 degrees C or more] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.
[0079]
Therefore, the imprint plate 10, and the base member 43, the carrier housing 47 and the contact sheet 45 [when it expands along with the temperature rise of a room temperature, respectively] Since the coefficient of linear expansion of carrier housing 47 grade is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.
[0080]
Drawing 13 (A) and (B) show other carrier units used for an example of the recovery approach of the electrode concerning this invention, respectively.
[0081]
In the carrier unit shown in drawing 12 (A) and (B), although the carrier housing 47 and the base member 43 of each other are concluded by the conclusion member 51 on both sides of the contact sheet 45 instead, in drawing 13 (A) and (B), the carrier housing 47 and the base member 43 of each other are joined on both sides of the contact sheet 45 by adhesives or fusion welding. In addition, in drawing 13 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.
[0082]
Carrier housing 47' is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion: 56x10-6/degree C) is desirable, for example. As shown in drawing 13 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47'A of carrier housing 47' is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part which forms the base of hold section 47'A of carrier housing 47', opening 47'b is formed in the center.
[0083]

Base member 43' is fabricated with the same ingredient as the ingredient of carrier housing 47', and has gage pin 43'P in four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 43'P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the field where the elastic sheet 41 is arranged. Let locator-pin 43'P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of base member 43', or the variation rate of contraction while it positions the relative position to base member 43' of the contact sheet 45. the base -- a member -- 43 -- ' -- a carrier -- housing -- 47 -- ' -- hold -- the section -- 47 -- ' -- A -- receiving -- a relative position -- fusion welding -- the time -- positioning -- having .

[0084]

Also in this example the imprint plate 10, and base member 43', and carrier housing 47' and the contact sheet 45 [when it expands along with the temperature rise of a room temperature, respectively] Since coefficient of linear expansion, such as carrier housing 47', is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0085]

drawing 14 (A) and (B) are used for an example of the recovery approach of the electrode concerning this invention, respectively -- being the further -- others -- a carrier unit is shown.

[0086]

the carrier unit shown in drawing 13 (A) and (B) -- setting -- the contact sheet 45 -- inserting -- carrier housing 47' and a locator pin 43, although the 'base member 43 which has P' of each other is joined instead -- drawing 14 -- (-- A --) -- and -- (-- B --) -- setting -- adhesives -- or -- fusion welding -- contact -- a sheet -- 45 -- inserting -- a locator pin -- 47 -- " -- P -- having -- a carrier -- housing -- 47 -- " -- the base -- a member -- 43 -- " -- mutual -- joining -- having -- a thing -- ** -- carrying out -- having . In addition, in drawing 14 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.

[0087]

Carrier housing 47" is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion: 56x10-6/degree C) is desirable, for example. As shown in drawing 14 (B), when being equipped with the lid 52 for press, the inner circumference section of carrier housing 47 "hold section 47" A is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part of carrier housing 47 "hold section 47" A, opening 47"b is formed in the center. In the surrounding external surface of opening 47"b, gage pin 47"P has projected at four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 47"P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the base. Let locator-pin 47"P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of carrier housing 47", or the variation rate of contraction while it positions the relative position to carrier housing 47" of the contact sheet 45. The relative position to base member 43" of hold section 47'A of carrier housing 47" is positioned at the time of fusion welding.

[0088]

Base member 43" is fabricated with the same ingredient as the ingredient of carrier housing 47."

[0089]

Also in this example the imprint plate 10, and base member 43", and carrier housing 47" and the contact sheet 45 [when it expands along with the temperature rise of a room temperature, respectively] Since coefficient of linear expansion, such as carrier housing 47", is set as size

rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0090]

Drawing 15 and drawing 16 show roughly the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention, respectively with the imprint plate fixed head.

[0091]

In addition, in drawing 15 and drawing 16 , the same sign is attached and shown about the component made the same in the carrier unit in the example shown in drawing 7 and drawing 8 , and the duplication explanation is omitted. Moreover, in drawing 15 and drawing 16 , the condition that some components of the carrier unit in the condition that the lid for press was removed were held in the carrier unit stage is shown.

[0092]

As the part is shown in drawing 15 and drawing 17 , a carrier unit The carrier housing 116 which has hold section 116A in which a bare chip 60 is held, The contact sheet 44 arranged through the elastic sheet 110 on the base member 108 which forms the pars basilaris ossis occipitalis of hold section 116A of the carrier housing 116, It is constituted including ratchet-mechanism 116F which hold alternatively the lid for press which comes to contain the press object which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and (un-illustrating) and its lid for press in the carrier housing 116.

[0093]

In addition, the above-mentioned lid for press which is not illustrated is equipped with the configuration in the example shown in drawing 8 , and the same configuration.

[0094]

Ratchet-mechanism 116F are constituted by the both ends of the carrier housing 116 as shown in drawing 7 including the hook member which is supported rotatable with a support shaft and holds the edge of the lid for press, and the coil spring which energizes a hook member in the direction made to engage with the edge of the lid for press, respectively, respectively.

[0095]

The carrier unit stage 106 has hold section 106A which holds the carrier housing 116 temporarily in the recovery of bump 44B of the contact sheet 44. As shown in drawing 15 and drawing 17 , in order to regulate the relative position to hold section 106A of the base member 108, the inner circumference section of hold section 106A which carries out opening towards the upper part is formed so that it may engage with the edge of the base member 108.

[0096]

As shown in drawing 16 and drawing 17 , the ratchet mechanism of the pair held removable in hold section 106A carries out phase opposite of the carrier housing 116 of a carrier unit, and it is prepared in the periphery section of hold section 106A. The ratchet mechanism is constituted by the wall which forms hold section 106A in the carrier unit stage 106 including the hook member 112 which is supported rotatable with the support shaft 118 and holds the periphery section of hold section 116A of the carrier housing 116, and the coil spring 114 which energizes the hook member 112 in the direction made to engage with the periphery section of hold section 116A, respectively, respectively.

[0097]

As shown to drawing 17 by the two-dot chain line, the end resists the energization force of a coil spring 114, and when equipped only with the carrier housing 116 of a carrier unit in hold section 106A, or when being removed from hold section 106A, the hook member 112 is rotated so that it may be isolated out of hold section 106A. On the other hand, when the carrier housing 116 is held in hold section 106A, the end of the hook member 112 is contacted by the periphery section of hold section 116A of the carrier housing 116 according to the energization force of a coil spring 114, as shown in drawing 15 and drawing 17 .

[0098]
When recovery is performed about the contact sheet 44 with which the bump was worn out so that it may mention later, the imprint plate fixed head is arranged in hold section 116A of the carrier housing 116 in a carrier unit, as shown in drawing 15 .
[0099]
The press object 102 which has fixed side 102a to which the imprint plate 104 is fixed as the imprint plate fixed head is shown in drawing 15 , The body 100 of a lid which has the crevice in which the base of the press object 102 is held, It is allotted to each space between the crevice of the base of the press object 102, and the comparatively deep crevice of the body 100 of a lid, respectively, and is constituted including two or more springs 103 which turn the imprint plate 104 to bump 44B of the contact sheet 44, and energize it.
[0100]
The base of the press object 102 is inserted movable into the comparatively shallow large crevice of the body 100 of a lid. 102n of claw parts which engage with the claw part prepared in the lower limit of the body 100 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 102 is inserted. [two or more] By this, the press object 102 will be held at the body 100 of a lid in the condition of having been energized by the energization force of two or more springs 103.
[0101]
One field of the imprint plate 104 made from a metallic material or a ceramic ingredient is being fixed by adhesion or the conclusion implement to fixed side 102a. Irregularity with predetermined flatness and predetermined surface roughness is formed in the field of another side of the imprint plate 104. In addition, the imprint plate 104 may be formed in the press object 102 and one, without being restricted to this example. Moreover, the press object 102 may be formed in the body 100 of a lid, and one, for example, without two or more springs 103 intervening.
[0102]
On the other hand, the lid for press of a carrier unit (un-illustrating) is held by the ratchet-mechanism 116F at the carrier housing 116, when a trial is performed to a bare chip 60.
[0103]
100s of female screw sections in which the male screw section of the load cell mentioned later is inserted is prepared in the abbreviation center section of the upper part of the body 100 of a lid.
[0104]
Drawing 18 shows roughly the whole sliding equipment configuration to which the contact sheet 44 is relatively moved to the imprint plate fixed head in the process of the recovery about bump 44B of the contact sheet 44.
[0105]
sliding equipment be constitute including the table device section which make it move in the predetermined direction , and the pressurization device section which the imprint plate fixed head be hold [section] and make a predetermined pressure act on bump 44B of the imprint plate 104 and the contact sheet 44 while fix the carrier unit stage 106 holding the carrier housing 116 with which it be allot on the base member 120 , and the contact sheet 44 be hold .
[0106]
The pedestal 122 matched with the table device section on the base member 120, and X shaft-orientations stage member 126 moved by the ball screw member 124 supported by the pedestal 122, Y shaft-orientations stage member 130 moved in the direction of an axis of the ball screw member 124 by the ball screw member 132 supported by X shaft-orientations stage member 126 along the direction which carries out an abbreviation rectangular cross, It is constituted including the rotation stage 136 which is supported rotatable by the stage supporter 134 allotted to Y shaft-orientations stage member 130, and holds a carrier unit.
[0107]
A pedestal 122 consists of a handstand surface part which carries out breadth extension in the direction which an arrow head Z shows to an abbreviation perpendicular to the flat part formed along the direction which the arrow head X in drawing 18 shows, and a flat part.

[0108]
X shaft-orientations stage member 126 is guided with a guide rail 168, and is supported by the ball screw member 124 movable through the nut. The both ends of the ball screw member 124 are supported by the edge which met in the direction which an arrow head X shows in drawing 18 in the flat part of a pedestal 122, respectively. The output shaft of the drive motor 160 fixed to a pedestal 122 through moderation device 160GH, such as an epicyclic gear device, is connected with one edge of the ball screw member 124. In addition, as for a drive motor 160, a linear motor, a stepping motor, a servo motor, etc. may be used. A drive motor 160 and each drive motor mentioned later are controlled by the control unit 150 mentioned later.
[0109]
Y shaft-orientations stage member 130 is supported by the inner circumference section of X shaft-orientations stage member 126 movable along the perpendicular direction at space with the guide rails 128A and 128B by which pair opposite arrangement is carried out. Moreover, Y shaft-orientations stage member 130 is supported by the ball screw member 132 movable through the nut. The both ends of the ball screw member 132 are supported by the edge which met perpendicularly in drawing 18 in X shaft-orientations stage member 126 at space, respectively. The output shaft of the drive motor 162 fixed to X shaft-orientations stage member 126 through moderation devices, such as an epicyclic gear device, is connected with one edge of the ball screw member 132. As for a drive motor 162, a linear motor, a stepping motor, a servo motor, etc. may be used.
[0110]
The drive motor 164 is being fixed to the center section of the stage supporter 134 fixed to the top face of Y shaft-orientations stage member 130. The stage supporter 134 is being fixed to the top face of Y shaft-orientations stage member 130 through the notch of X shaft-orientations stage member 126. It connects with the output shaft of a drive motor 164 inside the center of the disk section of the rotation stage 136 through moderation device 164GH. The side attachment wall of the rotation stage 136 is supported by the upper part of the stage supporter 134 rotatable through bearing 137. As for a drive motor 164, a linear motor, a stepping motor, a servo motor, etc. may be used.
[0111]
This will rotate the rotation stage 136 to the circumference of the medial-axis line of Y shaft-orientations stage member 130, and the medial-axis line of the stage supporter 134, when a drive motor 164 is made into an operating state.
[0112]
The carrier unit stage 106 is being fixed by the conclusion member to which illustration is abbreviated, for example, a **** member etc., to the disk section of the rotation stage 136.
[0113]
The pressurization device section is constituted including Z shaft-orientations stage member 140 which transmits thrust to the imprint plate fixed head, the ball screw member 142 which it is inserted in Z shaft-orientations stage member 140, and is supported movable, and the drive motor 166 made to rotate the ball screw member 142 while holding the load cell 138 which detects the thrust to bump 44B through the imprint plate fixed head, and a load cell 138.
[0114]
The both ends of the ball screw member 142 are supported by the bracket section of the pair prepared in a handstand surface part by having predetermined spacing rotatable, respectively. One edge of the ball screw member 142 is connected with the output shaft of the drive motor 166 fixed to a handstand surface part through moderation device 166GH. As for a drive motor 166, a linear motor, a stepping motor, a servo motor, etc. may be used.
[0115]
Z shaft-orientations stage member 140 is guided with the guide rail 144 so that it may be inserted in so that the ball screw member 142 may serve as an abbreviation perpendicular to the axis through a nut, and it may not rotate.
[0116]
The load cell 138 is connected with the body 100 of a lid by thrusting into 100s of female screw

sections of the imprint plate fixed head 138s of male screw sections connected with the internal sensor section. A load cell 138 sends out the detecting signal Sp which detects the thrust to the imprint plate fixed head of Z shaft-orientations stage member 140, and expresses thrust to a control unit 150.

[0117]

The migration direction command signal Sd showing the direction where the reset command signal Sr and the carrier housing 116 showing the instruction which returns the location of each stage member from the host computer for production control with which illustration is omitted to a predetermined criteria location should move to a control unit 150, the recovery initiation command signal Ss, and the detecting signal Sp from the above-mentioned load cell 138 are supplied.

[0118]

Moreover, the control unit 150 equips the interior with the memory section 150 in which the program data for performing the data showing the set point of the thrust to the imprint plate fixed head set up according to the contact sheet 44 or the set point of the movement magnitude of the carrier housing 116 (carrier unit stage 106) and recovery etc. are stored.

[0119]

The value of the thrust is set up according to the magnitude of bump 44B, for example, let it be the range of 1g or more per electrode 100g or less. As an example of the range of the minimum in the value of thrust, it considers as the range of 1g or more per electrode 40g or less.

[0120]

The movement magnitude of the one direction of the carrier housing 116 (carrier unit stage 106) is set up so that bending of the play of each device and the contact sheet 44 etc. may be considered, and it may be set up, for example, the relative movement magnitude of bump 44B may serve as the 1-micrometer or more range of 1mm or less. As an example of the range of the minimum in the relative movement magnitude of bump 44B, it considers as the 1-micrometer or more range of 100 micrometers or less.

[0121]

In the recovery by the 3rd example in the recovery approach of the electrode concerning this invention, first, as shown in drawing 18 , the carrier unit stage 106 in which the carrier housing 116 with which the contact sheet 44 with which the bump was worn out is arranged was attached is held at the disk section of the rotation stage 136 in a predetermined criteria location.

[0122]

Next, a control unit 150 sets up the movement magnitude of each stage member so that the movement magnitude of the carrier housing 116 and the carrier unit stage 106 may serve as a predetermined value based on the data in the recovery initiation command signal Ss, the migration direction command signal Sd, and the memory section 150.

[0123]

A control unit 150 sets up the movement magnitude of the Z-axis stage 140 based on the data of the set point of the thrust in a detecting signal Sp and 150m of memory sections in that case.

[0124]

A control unit 150 forms the pulse control signal Cz according to the set-up movement magnitude, and supplies it to the motorised circuit 158. Based on the pulse control signal Cz, a driving signal shall be supplied to the motorised circuit 158.

[0125]

Then, a control unit 150 forms the pulse control signals Cx, Cy, and Cr so that it may move the carrier housing 116 and the carrier unit stage 106 only once [at least] according to the set-up movement magnitude, and it supplies them to the motorised circuits 152, 154, and 156, respectively. Based on the pulse control signals Cx, Cy, and Cr, a driving signal shall be supplied to the motorised circuits 152, 154, and 156 to drive motors 160, 162, and 164, respectively.

[0126]

Thereby, only the specified quantity is made to move relatively bump 44B of the contact sheet

44 in the carrier housing 116 in the predetermined direction once to the imprint plate 104.
[0127]
Therefore, the comparatively detailed irregularity corresponding to the press and sliding of an imprint side of minute irregularity in the imprint plate 104 will be formed in the edge at which the bump was worn out, without applying comparatively big thrust like the case of the 1st above-mentioned example. The irregularity is spacing of for example, about 0.1-micrometer or more 50-micrometer or less extent, and is formed in about 0.001-micrometer or more height of 5 micrometers or less. As range of the minimum of the irregularity, it is spacing of about 0.1-micrometer or more 50-micrometer or less extent, and considers as the range of about 0.002-micrometer or more height 3 micrometers or less, for example.
[0128]
Moreover, in this example, since it is not necessary to heat like [in the case of the 1st example], control of the amount of sliding in recovery is easy, and it can process comparatively for a short period of time, consequently is more suitable for mass-production nature.
[0129]
And that thrust should be canceled, a control unit 150 forms the pulse control signal Cz, and supplies it to the motorised circuit 158.
[0130]
The carrier housing 116 with which the contact sheet by which recovery was carried out is held is removed from the carrier unit stage 106. In that case, a control unit 150 forms the control pulse signals Cx, Cy, Cr, and Cz, and supplies them to the motorised circuits 152, 154, 156, and 158 so that it may return the location of each stage member to a predetermined criteria location based on the control signal Sr supplied.
[0131]
After being equipped with a bare chip 60 and the lid for press, the hold section of IC socket 30 will be equipped with the removed carrier housing 116 as a carrier unit like an above-mentioned example.
[0132]

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] (A) and (B) are drawings showing typically each process of the 1st example of the recovery approach of the electrode concerning this invention, respectively.
[Drawing 2] (A) is a fragmentary sectional view with which is a fragmentary sectional view with which explanation of each process is presented, and a bump's point in the process shown in drawing 1 (B) expands (B) partially, is shown [a bump's point in the process shown in drawing 1 (A) is expanded partially, and is shown, and], and explanation of each process is presented.
[Drawing 3] (A), (B), (C), and (D) are fragmentary sectional views with which a bump's point in each process of the 1st example of the recovery approach of the electrode concerning this invention is expanded partially, and is shown, respectively, and explanation of each process is presented.
[Drawing 4] (A), (B), and (C) are fragmentary sectional views with which a bump's point in each process of the example of a comparison is expanded partially, and is shown, and explanation of each process of the example of a comparison is presented, respectively.
[Drawing 5] (A), (B), and (C) are drawings with which explanation of each process at which a bump's tip is worn out by use is presented, respectively.
[Drawing 6] A bump's tip which a bump's tip is expanded partially, respectively, and (A), (B), and (C) are shown, and is shown in drawing 5 (A), (B), and (C) is drawing with which explanation of each process worn out by use is presented.
[Drawing 7] It is the fragmentary sectional view showing an example of the socket for semiconductor devices equipped with the contact sheet with which the 1st example and the 2nd example of the recovery approach of the electrode concerning this invention are applied.
[Drawing 8] It is the fragmentary sectional view showing roughly the configuration of the carrier unit in the example shown in drawing 7 .
[Drawing 9] It is a top view in the example shown in drawing 8 .
[Drawing 10] (A), (B), and (C) are the fragmentary sectional views expanding and showing the important section with which explanation of each process of the 2nd example of the recovery approach of the electrode concerning this invention is presented, respectively.
[Drawing 11] (A), (B), and (C) are the fragmentary sectional views expanding and showing some drawings shown in drawing 10 (A), (B), and (C), respectively.
[Drawing 12] (A) is the block diagram decomposing and showing the configuration of an example of other carrier housing used for the 1st example of the recovery approach of the electrode concerning this invention, and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).
[Drawing 13] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention — being the further -- others — it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).
[Drawing 14] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention — being the further -- others — it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is

the block diagram showing the configuration of the carrier unit containing carrier housing in (A).
[Drawing 15] It is the sectional view showing the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention with the imprint plate fixed head.
[Drawing 16] It is a top view in the example shown in drawing 15 .
[Drawing 17] It is the block diagram decomposing and showing the configuration of carrier housing shown in drawing 15 , and a carrier unit stage.
[Drawing 18] It is the block diagram showing the whole sliding equipment configuration used for the 3rd example of the recovery approach of the electrode concerning this invention.
[Description of Notations]
10a Irregularity
10,104 Imprint plate
10s Imprint side
12 Thermostat
44 80 Contact sheet
44B, 44B', 44B″, and 84B and 84B -- ' -- Bump
44a, 44ps, 44ms, 84a Irregularity
44M, 84M Base material
60 Bare Chip
86 Crystal Object
126 X Shaft-Orientations Stage Member
130 Y Shaft-Orientations Stage Member
136 Rotation Stage
140 Z Shaft-Orientations Stage Member
160,162,164 166 Motor for a drive

[Translation done.]

* NOTICES *

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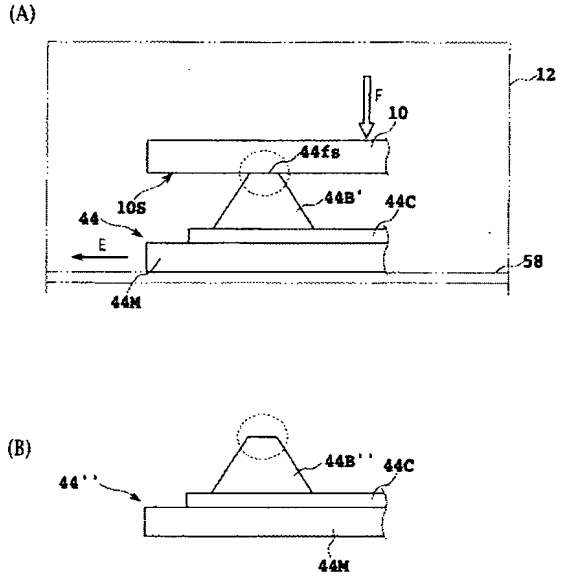
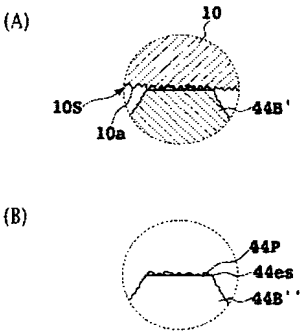
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

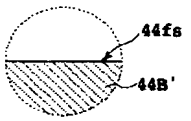


[Drawing 2]



[Drawing 3]

(A)



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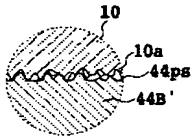

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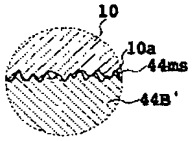

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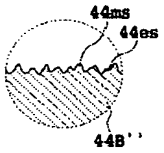
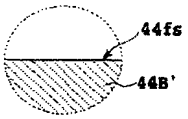


[Drawing 4]

(A)



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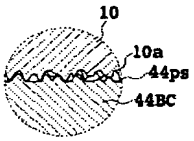
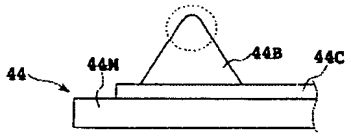


(C)

[Drawing 5]

(A)



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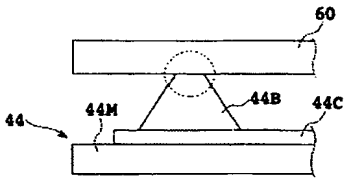

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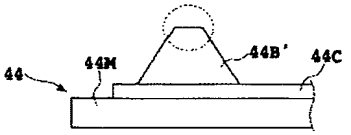
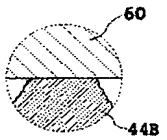


[Drawing 6]

(A)

(B)



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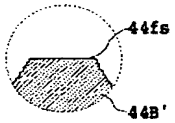

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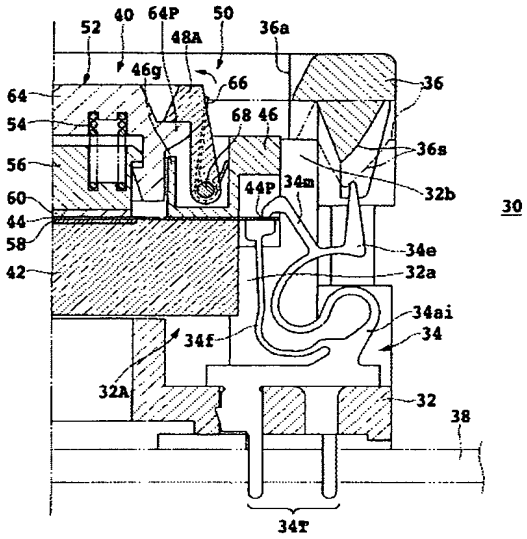

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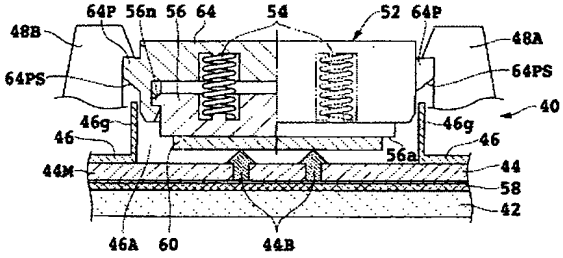

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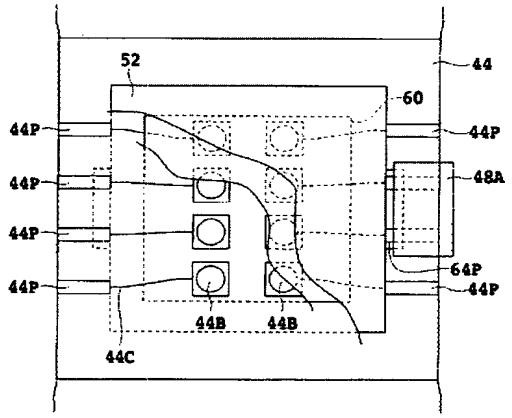
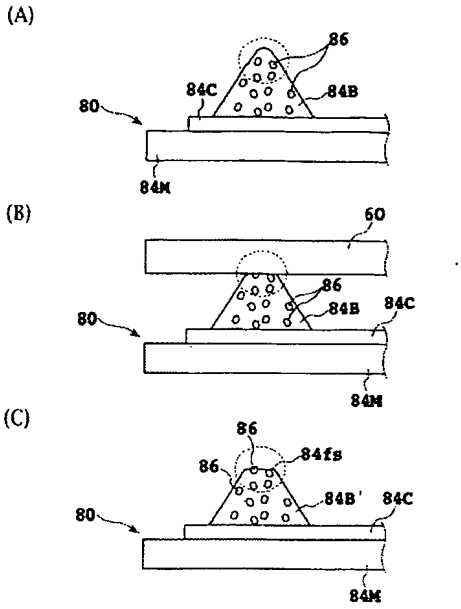


[Drawing 10]



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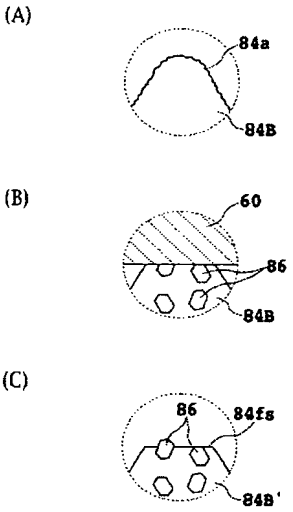
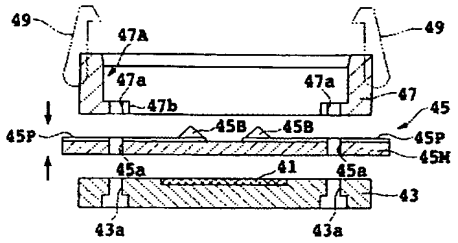


[Drawing 12]

(A)



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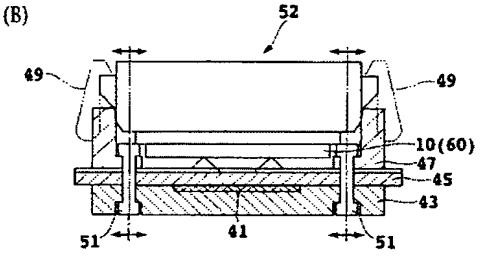
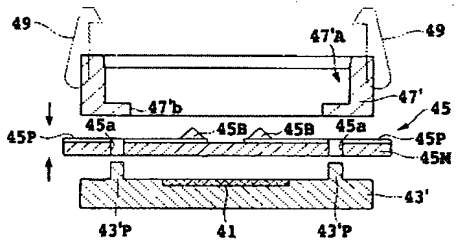


[Drawing 13]

(A)



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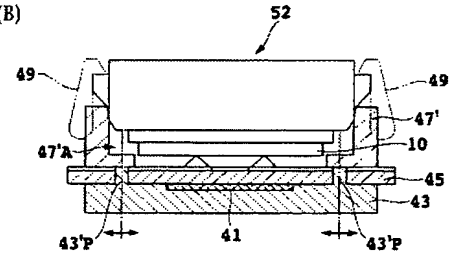
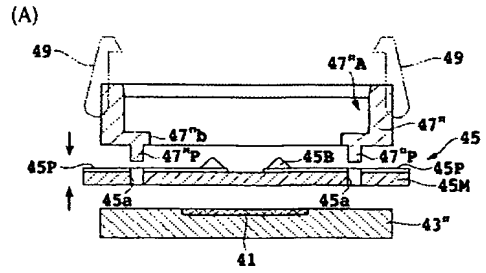
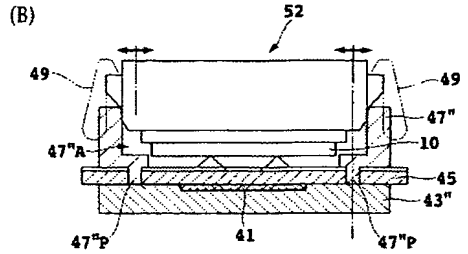
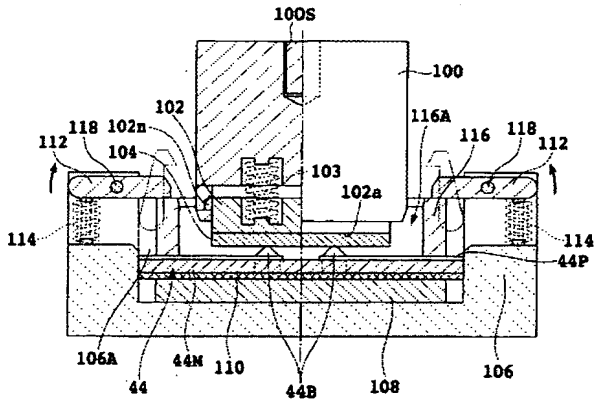


[Drawing 14]





[Drawing 15]



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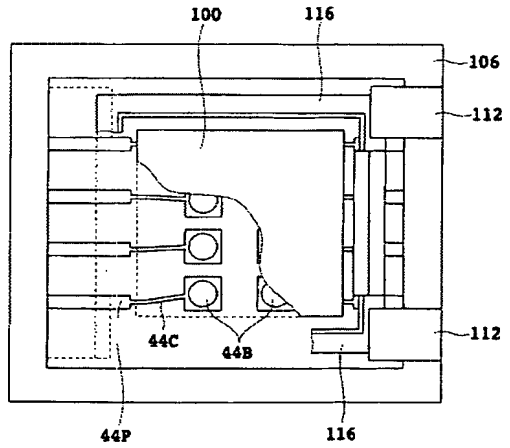
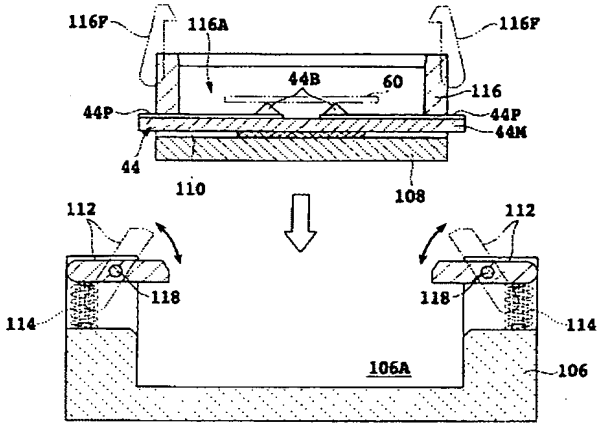
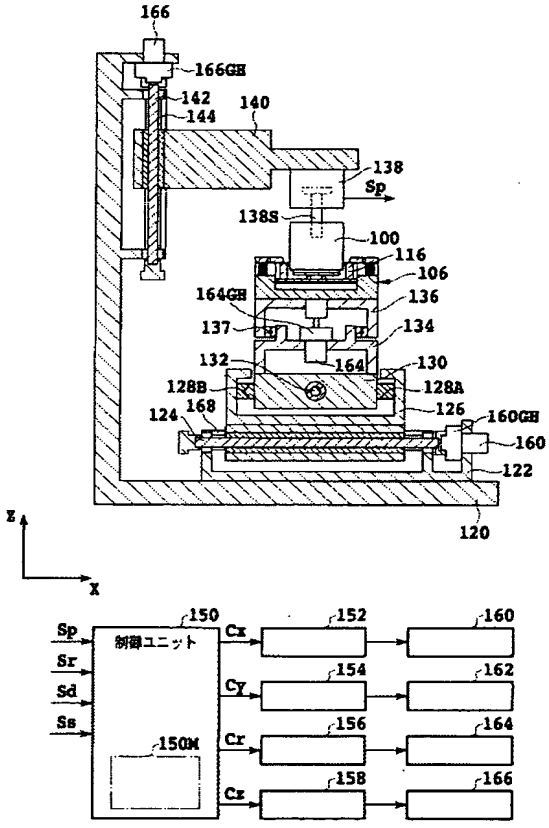


[Drawing 17]



[Drawing 18]



[Translation done.]